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FOR MANAGEMENT

JANUARY 1958

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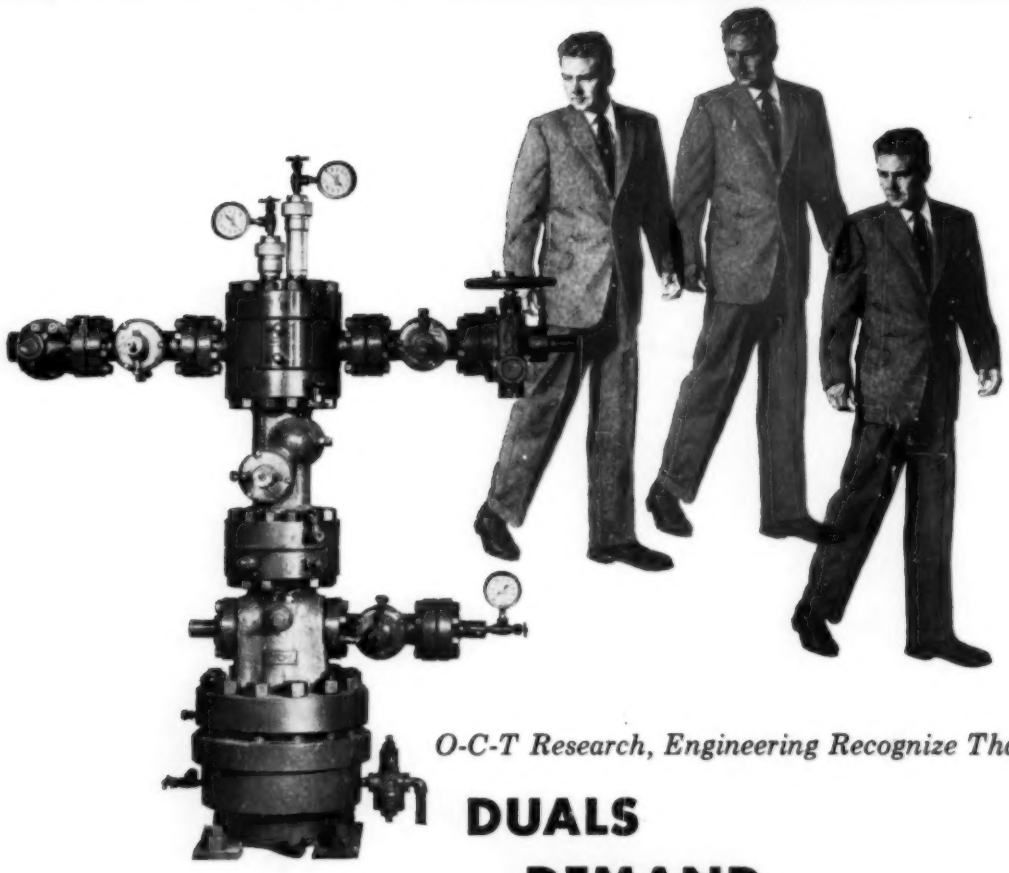


O-C-T Research, Engineering Recognize That

DUALS DEMAND DISCRETION

That's Why the Better Operators Pick O-C-T Dual Completion Trees

Well control equipment isn't picked by the flip of a coin—and certainly not dual completion equipment. Dual flows can pose problems . . . but not when the installation bears the Oil Center Tool Company brand.

O-C-T offers precision dual wellhead units for multiple completions whether they be shallow depth, medium or ultra deep . . . whether they be low pressure or high pressure wells.

O-C-T dual assemblies feature, depending on the need:

- The Universal Tubing Head. This head is available with a complete range of interchangeable tubing hangers for both dual and single completions.
- The "UA" Attachment. This adapter converts any A.P.I. Tubing Head to a Universal Head.
- The Delta Flange. This flange gives the greatest strength and balanced load distribution in a dual string completion using individual master valves.
- Versatility. This means O-C-T assemblies can be converted over easily to dual hookups even when multiple completions were not anticipated.

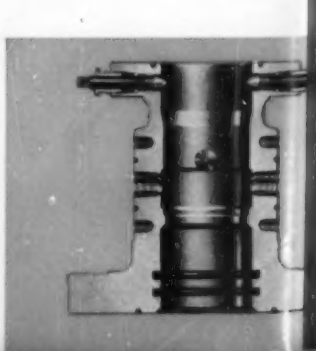
O-C-T long has been a leader in development of fine dual completion trees. O-C-T will continue to be.

OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Export Representatives: South America – East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

An example of the versatility found in O-C-T hookups is the Universal Tubing Head which is available with a complete range of interchangeable tubing hangers for both dual and single strings. Last minute changes in completions can be made without changing tubing heads or using special attachments. If only one producing sand is found in a projected dual well, the well may be completed by using a single string hanger. On the other hand, if a single completion is anticipated and two zones found, the well may be completed with a dual hanger.



NEW ELECTRIC INDUCTION HEATING PROCESS

IN FORGING

UNRETOUCHED PHOTOGRAPH OF PRIMARY FORGING

Electric-induction coil with fully automated controls for heating rod end shown above.

. . . in most MODERN SUCKER ROD PLANT in the Oil Industry!

Electronics and automation are combined and utilized as far as practicable in most advanced technology.

1. Electric-induction coil heating for forging produces a rod-end virtually scale-free, no *imbedded* scale whatever — the slickest forging you ever saw!
2. Automated controls govern predetermined progression, cycles, and temperatures throughout — permitting *multiplication* of inspections in process.

THESE ARE BUT *TWO* OF THE FEATURES IN THIS NEW NORRIS TECHNOLOGY. OTHERS WILL BE DESCRIBED IN SERIES TO FOLLOW.

W. C. NORRIS, MANUFACTURER

DIVISION OF DOVER CORPORATION

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A Magazine of Petroleum Management

the Petroleum Engineer

FOR MANAGEMENT

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SIX RESOLUTIONS FOR 1958

I BELIEVE the petroleum industry diligently works to provide ample supplies of quality products wherever wanted at fair prices;

I RESOLVE to do my part to help people understand and appreciate our problems and our achievements in reaching this main objective.

I BELIEVE that the industry must have a profit sufficient to expand exploration and operating facilities and pursue a research program, as well as provide investment returns;

I RESOLVE that my efforts will be toward more efficient operations so these earnings can be realized while protecting the consumer from undue price increases.

I BELIEVE petroleum management has done a good job of employee training, of maintaining good wages, of providing sound benefits, of improving job security;

I RESOLVE that as part of management I shall work for job satisfaction for each employee within my jurisdiction.

I BELIEVE our industry is one of the most stable, with less fluctuation in demand than most other businesses experience;

I RESOLVE whenever possible to plan expenditures against the trend of general business, choosing to expand more during periods of a slow economy than during boom times.

I BELIEVE my specialized knowledge has deep roots in facts contributed by those who have preceded me in the industry;

I RESOLVE to add my gains of information to the great fund of knowledge on which we build our industry's progress.

I BELIEVE the petroleum industry has done more than any other to free man physically;

I RESOLVE that so far as I can make my influence felt, the industry shall also stand for economic and political freedoms.

"talk about flow... this will be a real producer!"

With improved exploration techniques and improved drilling equipment . . . plus the ever spiraling demand for oil and gas . . . the New Year of 1958 should be a real producer! Joe Roughneck . . . heart of the petroleum industry . . . is certain to do one of the greatest jobs in his long and colorful career. Joe's efforts will be aided by his neighbor, Lone Star Steel . . . maker of top quality API casing, tubing and line pipe. Lone Star's big, completely integrated steel mill is dedicated to Joe Roughneck's team in the busy Mid-Continent area . . . and will deliver API pipe on the double.

Neighbor, wherever you are . . . specify Lone Star and we both get a good deal!

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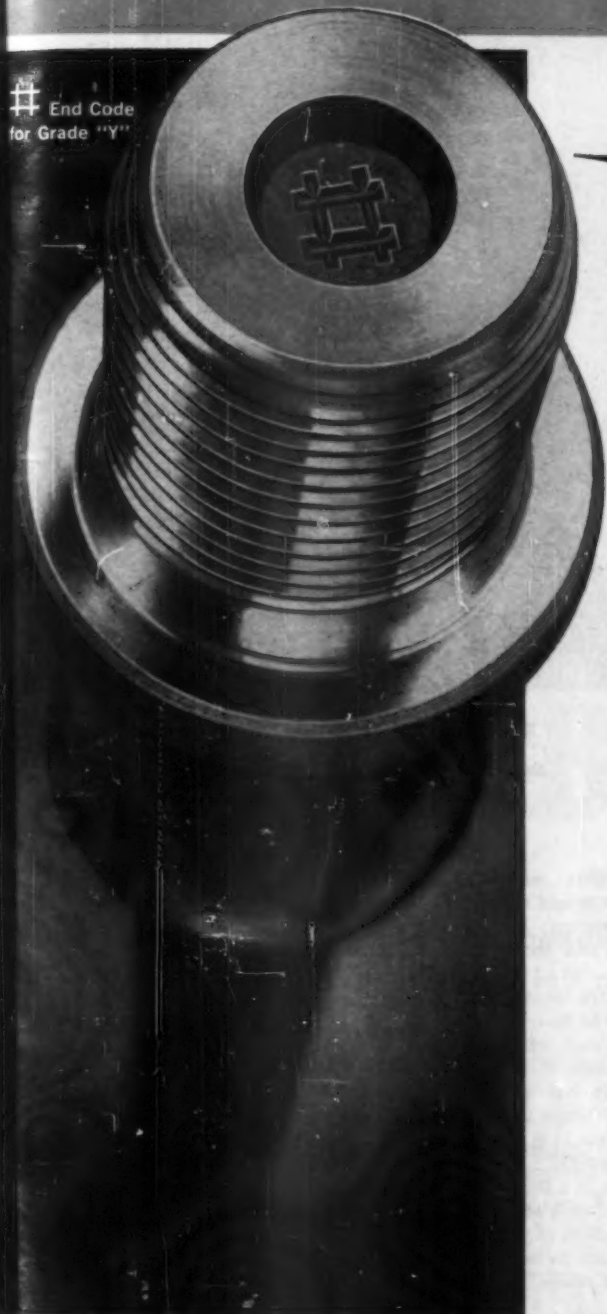
TOUGHNESS and STRENGTH! *This* Sucker Rod has *Both!*



YOU MAY FEEL that this is an impossible combination, because sucker rod steels harder than Rockwell C#24 (Brinell 246) must generally sacrifice toughness, which is so essential to long service under reciprocating pumping stresses. But in this rod we have an UNUSUAL steel!

Metallurgical research found that elastic strength (for toughness) could be increased by the addition of boron in the steel alloy, without raising the hardness (for strength) above the maximum safe limit for sucker rod steels used in reciprocating field applications.

However, small amounts of boron DO NOT IMPART THIS TOUGHENING CHARACTERISTIC unless the steel is LIQUID-QUENCHED . . . and our sucker rod manufacturing plant is currently the only source for sucker rods that are liquid-quenched over their entire length.

Some years ago, we decided to manufacture a few carloads of sucker rods from boron-alloy steel, based upon the high-toughness safe-hardness concept stated above. They proved outstanding in their ability to lift heavy loads and withstand rapid reversals over long periods of time. Consequently, they were placed in regular production.

These rods were given the grade letter "Y" and the color-code banding "YELLOW."

Field performance has now proven that these rods give exceptional service in corrosion-inhibited deep wells, or wells having mild sulphide brines. Yet because costly alloying (to resist corrosion) is avoided, these rods are relatively inexpensive.

So . . . for high strength at low cost, in your next non-corrosive or corrosion-controlled well, use a string of "Oilwell" grade "Y" sucker rods. Or make your own test! Alternate grade "Y" rods with whatever brand you are now using. Then choose the rods which serve you best. We are confident they will be "Oilwell's" grade "Y."

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Petroleum Profile

NO MATTER where you stand on the imports question you can admire Robert L. Wood for his leadership of IPAA in its fight to cut imports.

As president of the Independent Petroleum Association of America for two years, 1956-57, when the intra-industry division over imports grew and grew, Bob Wood had an unenviable task on his hands. He never changed from the calm and friendly approach and he never swerved from his determined stand that imports were supplanting instead of supplementing domestic production.

He did a remarkable job. The Special (Cabinet) Committee to Investigate Crude Oil Imports adopted a policy of limiting imports in the national interest and President Eisenhower approved it. Woods points out that W. M. (Bill) Vaughey, chairman of IPAA executive committee, laid the ground work for the project seeking limits on imports when he was IPAA president, and he continued to help. Truth to tell, Bob Wood and Bill Vaughey made a good working team. Wood says credit for any progress in settlement of the import problem belongs to many. "In any industrial problem worthy of solution there must be shock troops. In the case of imports, these have been officers and members of IPAA as well as those of the 20 other state and regional associations that cooperated on the problem."

ROBERT L. WOOD

Basin Drilling Company

Bob is a Dallas, Texas, product, who went West — to West Texas, that is. First he attended Austin College, Sherman, Texas, and afterward worked for General Motors from 1931-1939. When he became co-owner of The Western Company, an oilfield service company with headquarters at Midland, he went to West Texas.

He and his wife, who was formerly Mae Hooks Files of Itasca, Texas, and two children, Robert L. Wood, Jr. and Lee Files Wood, moved to Midland, Texas, in 1941. Mr. and Mrs. Wood have made it their permanent home. Bob, Jr. is married now and he and his family — there are three children — live in Albuquerque, New Mexico. He works for Humble Oil and Refining in the land department. Lee is now serving in the U. S. Marines, stationed at Camp Pendleton, California.

In 1946 Mr. Wood sold his interest in The Western Company and organized Frontier Chemical Company. He left Frontier to become president of a drilling contracting firm, which he bought out and still owns and manages as Basin Drilling Company. His rigs operate in Permian Basin and North Texas areas.

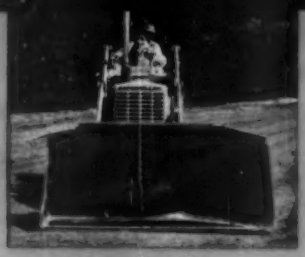
Besides his heavy work for two years as president of IPAA and his own drilling and producing business, Mr. Wood works for his community, his church, and his industry. He has dynamic energy and he doesn't waste it. He is a Chamber of Commerce man — Midland, West Texas, and U. S. — and, among other activities, is a director of Community Chest and of YMCA. He is on the Board of Deacons of the First Presbyterian Church and on the Board of Trustees of Austin College, his alma mater.

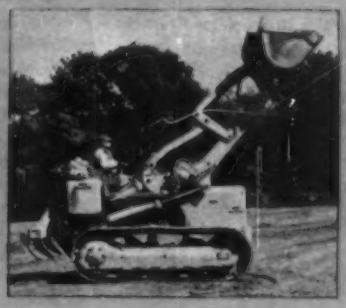
Mid-Continent Oil and Gas Association, American Petroleum Institute, National Petroleum Council, and American Association of Oilwell Drilling Contractors have benefited from his good judgment and warm personality.

Austin College Alumni named him "Distinguished Alumnus of the Year" in 1957, a deserved tribute to a man of sound accomplishment.

Mr. Wood has other business connections, too: President and director of First Savings and Loan Association, honorary vice president and director of Commercial Bank and Trust Company, and director of Central Airlines. The first two companies are in Midland and the last has headquarters in Fort Worth.

One of Mr. Wood's proudest claims is that in the course of taking the offensive in one of the industry's longest smouldering controversies, he has managed to make more friends than enemies. "I have found if you disagree with a fellow with the right attitude and the right kind of language, you can still retain his friendship," he says.

Here  comes...

the TRAXCAVATOR'S  new...

SIDE DUMP BUCKET!

—Directly interchangeable with standard bucket...same pins, bolts and nuts!

—Easy to operate! Dumps to the left as well as forward!

Now the famed Cat-built No. 955 and No. 933 Traxcavators are more versatile than ever! The new Side Dump Bucket attachment gives you

- Higher production, because cycle time can be cut
- Lower maintenance, greatly reduced ground scuffing, because turning when loading is no longer necessary
- Easier handling because the unit now needs less space for loading and truck spotting.

Side Dump Buckets Available for the No. 955 and No. 933 Traxcavators!

	No. 955	No. 933
Bucket capacity	1⅛ cu. yd.	1⅛ cu. yd.
Overall width of bucket	96"	86⅛"
Overall height, side dump	17' 5½"	15' 6 1/16"
Overall height, level	14' 6"	12' 11 1/16"
Left side dump reach	24½"	25½"

And you retain all the regular Traxcavator's popular features. Lockout-kickout, bucket positioner, 40-degree tilt-back, one-hand bucket control. No interference, either, with other Traxcavator* attachments when you equip with the new CAT* Side Dump Bucket. Get complete details from your Caterpillar Dealer *now!*

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

A NEW DIMENSION IN LOADER VERSATILITY

THE CONFERENCE TABLE

"Political determinations have become controlling factors in our economic life." — PHILIP D. REED

Outlook 1958

This month, as usual, we bring you a preview of the new year by knowledgeable executives of the petroleum industry. They've made some canny analyses of 1957 and promise an interesting but not easy 1958. (Page A-17.)

Our national economy may rise faster than we think although authorities predict a slow first half. Here are some reasons we look to an upturn before six months is gone:

1. Extra billions of dollars for missiles.
2. There'll be 3 million more people to provide for.
3. Credit terms easing after Federal Reserve interest cut.
4. Capital investment will be higher than any year except 1957.
5. Spending continues at near record high marks.
6. Sputniks put us in the mood to move.
7. Federal highway system will add to construction, push travel.
8. Unemployment (mostly unskilled) is developing needed pressure for better education, better training, more skills.

Automation can lower production costs by increasing productivity of the individual workers and by better control of production and business... Dr. John T. Rettaliata.

It's a Survival Struggle

Scientists and politicians have been emphasizing the life-and-death fight between the Communist world and ours. Can a democracy be galvanized into action when it means sacrifice in the present? Will a majority see far enough ahead to understand the nation must develop strength or die?

Another battle is being waged that many — perhaps the majority — do not comprehend. As Russell H. Hassler, Harvard Graduate School of Business Administration, says (Page A-27) "While many of us may not like it, we are facing the issue of survival."

C. H. Lyons, president of Mid-Continent Oil and Gas Association, has repeated the same warning to the petroleum industry in speech after speech. (See Page A-25.)

We must compromise our differences if we hope to survive as an independent industry.

These are indeed crucial times. Let us resolve to develop an awareness of our foes and to do whatever it takes to survive.

Dividends Up $400 Million

November dividends brought the 11-month total to $9.4 billion, up from $9 billion in the like 1956 period. Corporate dividend payments rose to $325 million in November, $10.6 million more than a year ago, the Commerce Department reported. The increase over last year's total was in line with the average gain of 3½ percent shown in earlier months this year, the agency said.

Gains 100,000 Stockholders

Sunray Mid-Continent Oil Company has joined the ranks of the select and limited group of U.S. business corporations which boasts more than one hundred thousand stockholders.

Of the more than 1500 U.S. corporations whose common stock is listed on the New York Stock Exchange, only 21 have more than 100,000 stockholders of record and Sunray has become the twenty-first and latest corporation to be so designated.

W. D. Forster, secretary of Sunray, announced here today that the 100,000th individual name as a holder of common stock shares in the company has been registered in the stockholder record book. The 100,000th stockholder will be notified early in 1958 and will be specially invited to attend the annual meeting of Sunray stockholders in Tulsa next May.

All the things I really like to do are either immoral, illegal or fattening... Alexander Woollcott

How to Forecast

It seems too bad to spend much time learning how to forecast the business outlook when even the best economists can hit it so wrong. Read back about 5 or 10 years and you'll know it isn't easy. The surprising thing to us is how well they do, considering the difficulty of seeing into the future.

American Management Association has published a thin book on "Company Organization for Economic Forecasting" (Research Report No. 28, American Management Association, 1515 Broadway, New York 36, New York) which tells something about how it is done, its usefulness, and sources of economic information.

Taking the case study of one oil company, for instance, the chapter covers (1) content and preparation of reports; (2) circulation and use, and (3) additional reports and checks.

This company has what is termed an "old" group; it began in 1936. The foreseeing business is young but it has proved its value.

People who try to get rich from mining often put more into the ground than they take out of it... Bernard Baruch

Promise of Colombia

Riches of the earth have lured men to the four corners of the globe. Gold and gems were once the magnets. Now oil and iron, copper and uranium attract enterprises and capital.

In our "Foreign Areas of Promise" series, we have chosen countries with great oil potential. Colombia, our second in the series, is reported on next month. Every operation will be covered from geology to economics. You won't want to miss this intriguing picture of oil in Colombia.

Court Doubts Oil Prospects

The U.S. Circuit Court of Appeals has sustained a new loophole in the Wage-Hour Act. The Court held that the drilling of a dry hole in area where there is no reasonable prospect of finding oil is not "production of goods for commerce" and, therefore, not subject to the Fair Labor Standards Act.

Driller in this case (*Sealy vs Mitchell*, Secretary of Labor) was described as a "doodlebug" operator who put great stock in forked twigs and similar devices to locate oil. The well was drilled in Georgia where the Court said: "From a practical standpoint, judged in the realities of the industry, not a single qualified person expressed even a remote opinion that there were any prospects for oil at this location." The Court noted that, if the drilling had been done in an area where commercially producing wells were common, the employees would have been covered by the Act, even though they drilled a dry hole.

One judge dissented, saying that the employer's "foolish or reckless" conduct should not be allowed to defeat the employees' claims and abuse "the dignity of labor."

It's a world full of risk and few of us will get out alive.

The Managed Dollars

An enterprising New York City concern is advertising an unusual gift for special occasions. It's the old "Double Eagle," or $20 gold piece, out of circulation since the 1930's.

It was taken out of circulation when it was decided in Washington that the currency need not be backed by gold and could be "managed" by the experts there.

The results of this management can be seen in the "managed" dollar price for the $20 gold piece: $52.50.

At Last— Those Highways?

So far the most visible result of the "grand plan" Federal highway program has been the extra 1c a gallon Federal tax. In our Outlook last year we used promised highway building as a basis for some of our 1957 predictions. We still believe 1957 will top 1956 for the petroleum industry, but not because of Federal highway construction.

In his API speech Bertram D. Tallamy, Federal Highway Administrator, Bureau of Public Roads, said construction work as of November 1 was underway or about to get underway on 2576 miles of the Interstate System of a total cost of $1.3 billion. Total construction of Interstate and Defense Highways involves 41,000 miles.

Right now the Federal gasoline tax is coming in faster than it is being spent on highways, but the program has been blueprinted and is ready for conversion into good roads.

This should give the oil industry a big shot in the arm. Oil products will be needed in volume for the construction work (Administrator Tallamy figures 13 billion gallons) and increased travel on petroleum energy should result from this expanded highway system.

Union Rolls Grow

U.S. labor unions have a million-member increase and a $162 million rise in dues since 1955. This is the result of a second survey by the National Industrial Conference Board. Total membership of 191 unions surveyed totals 18,350,000 compared to 17,500,000 two years ago. Dues in 1957 were $620 million.

Some People Like Us

Duncan (Oklahoma) Chamber of Commerce had an Oil Appreciation banquet last month and honored seven persons who had contributed a total of 210 years to the petroleum industry. There must be many other cities where oil people are appreciated but we're always hearing about the people who have a dim view of the petroleum industry.

Back to Duncan. Here are the ones who were awarded plaques for "aggressive leadership and distinguished service": Mrs. Nora Cunningham, secretary to J. Grover Kilgore, Halliburton vice president; N. Hill, jobber for Magnolia; A. D. Stoddard, vice president, J. H. & S. Petroleum Corporation; Ollie K. Wright, retired from Magnolia; C. V. Stinchecum, lease broker; L. B. Simmons, independent (sold Rock Island refinery to D-X Sunray); and Logan D. Campbell, board chairman, Howco.

Congratulations to these seven. And we send our appreciation to Duncan Chamber of Commerce.

Facts do not cease to exist because they are ignored...
Aldous Huxley

Buying More Capital

Jersey Standard has completed its sale of stock to raise money for capital spending. Now Royal Dutch is filing a registration statement to offer 7,602,285 shares, proceeds to be used primarily for capital and exploration expenditure programs. In order to finance in part its proportionate share of such programs, Shell Transport expects to offer additional shares to its shareholders shortly after the Royal Dutch offering.

The Royal Dutch/Shell Group is an integrated group of over 500 companies, the members of which are severally engaged throughout the greater part of the world in one or more phases of the oil industry, including the exploration for crude oil and the production, purchase and transportation, refining and marketing of crude oil and oil products and in the manufacturing and marketing of chemicals.

During the five years and nine months ended September 30, 1957, the companies of the Royal Dutch/Shell Group expended £1,781,000,000 (approximately $4,987,000,000) in the acquisition and replacement of property, plant and equipment and in the search for additional crude oil reserves. Of the total capital and exploration expenditure during this period, approximately 35 percent was in the United States, 27 percent was in the rest of the Western Hemisphere and 38 percent was in Europe and the rest of the Eastern Hemisphere.

HIGHLIGHTS ★ ★ ★

Digest of News and Comment

New oil yardstick has been established by Consulting Geologist Dr. Frederic H. Lahee: It is a ratio of one commercial discovery out of 10 ventures. The data is a result of a detailed study of exploration from 1944 to 1956, in which he found that of 2309 new-field discoveries, 318 of them have been depleted or are no longer commercial. It was Lahee who gave the industry its "one good field in nine wildcats" yardstick.

★ ★ ★

New Mexico Oil and Gas Association has re-elected Joe Lackey as its 1958 president. Lackey is vice president of Malco Refineries, Inc. New vice president is S. P. Yates of Artesia; Ernest A. Hanson of Roswell was re-elected treasurer. Executive committee includes: T. H. Hammett, Sinclair, Denver; M. H. Winter, Atlantic, Midland; Al Greer, Benson-Montin-Greer, Farmington; C. B. Read, Roswell, and Paul Johnston, Hobbs, both independents.

★ ★ ★

Canada's natural gas industry will never mature unless an adequate export market is assured, says E. D. Loughney, vice president of British American Oil Company, Ltd. Canada's needs have already been fulfilled; new discoveries are adding to the reserve. Exploration resulted in 8.7 gas wells for every 10 oil wells discovered. These have proved up 3 trillion cu ft per year — with an additional 2 trillion per year increase anticipated. Present reserves exceed 24 trillion cu ft.

★ ★ ★

Merger negotiations have been halted between Dresser Industries and Gardner-Denver Company, despite statements by officials last month that the two oil equipment manufacturers would integrate. Differences developed between officials of the two companies concerning centralization of authority in the proposed organization.

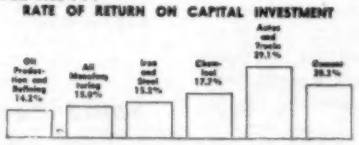
★ ★ ★

Fifth World Petroleum Congress, to be staged in New York during June 1959 is fast taking shape. It is expected that some 5000 delegates will attend the 70 to 80 technical sessions and the oil exposition that is scheduled to run concurrently with the Congress. It will mark the first time the Congress will be held in the United States and will fall within the American Petroleum Centennial.

WITH ONLY TWO PRICE INCREASES IN 9 YEARS

JUST WHY IS OIL UNDER ATTACK?

FOR 1955 . . .
RATE OF RETURN ON CAPITAL INVESTMENT



American Association of Petroleum Landmen

The oil situation is at its worst now, says Edmund C. Lynch Jr., head of the petroleum securities research department of Merrill Lynch, Pierce, Fenner & Beane. The industry's status will not change early in 1958, but the end of the coming year should find an improved oil picture. Product inventories are beginning to level off, and a cold winter would help, he said. One cause of the current problem is that demand did not live up to its expectations in 1957. Demand rise during the past year has been 0.1 percent, as compared with a 4 percent rise predicted earlier.

★ ★ ★

Oil imports are being cut back to the satisfaction of Captain M. V. Carson, administrator of the voluntary imports program. At the Interstate Oil Compact Commission meeting in Tulsa, Carson indicated that crude receipts for November were 200,000 bbl per day less than previously scheduled. Three companies that exceeded their import quotas were reducing them. Tidewater cut back its imports 40,000 bbl below August figures, despite requirements for its new Delaware refinery.

★ ★ ★

Louisiana state land leasing has been halted by the State Mineral Board in an attempt to find reasons for fewer and lower bids and less acreage nominated. Chairman William G. Helis indicated that the board would also "find out whether our problem is caused by the distressed national market, and what role the importation of oil from the Middle East and Venezuela is playing in this overall picture." The state received nearly $20,000,000 less from its leases this year than last. It cancelled a sale scheduled December 11 because of the lagging interest.

A three-man Conservation Committee has been named by the provincial cabinet of British Columbia to assist the administration of its growing oil and gas industry. Committee chairman is A. N. Lucie-Smith, who has a 28-year background with exploration companies in Venezuela and Australia prior to joining the B. C. Department of Mines. Other members are N. D. McKechnie and M. H. A. Glover. McKechnie was a geologist with several Canadian firms before joining the department; Glover is an economist.

★ ★ ★

Increased rentals on oil leases on some public lands open to oil and gas exploration may be increased in an attempt to put federal "service" agencies on a self-supporting or profitable basis. Plans of the Budget Bureau, indicates Director Percival Brundage, include raising rates and fees, rents, and charges of several agencies if possible; if not, then changes in law by Congress would be considered.

★ ★ ★

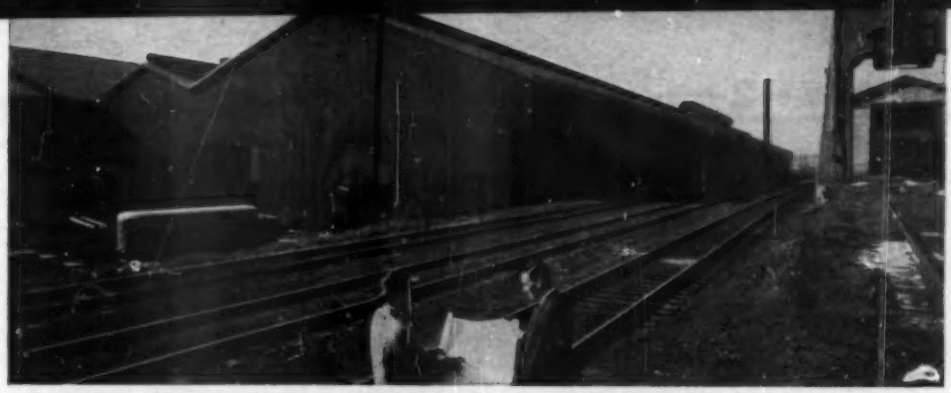
Canadian oil producers are pinched, the Alberta Conservation Board indicates. In that province, fields produced only about 40 percent of their capacity in December. Restricted output was 301,609 bbl per day — only 11,178 bbl daily more than that for November, the lowest allowable in 2½ years.

★ ★ ★

Recognition of Texas' claim to its tidelands to a 10½-mile boundary has been reaffirmed by President Eisenhower in a letter to Jack Porter, Texas National Republican Committeeman. In the letter he expressed regrets that the submerged lands act of 1953 did not make boundaries clear. "As I have said before," the President stated, "It is my earnest hope that the submerged lands act establishes Texas' three-league historic boundary as a matter of law."

★ ★ ★

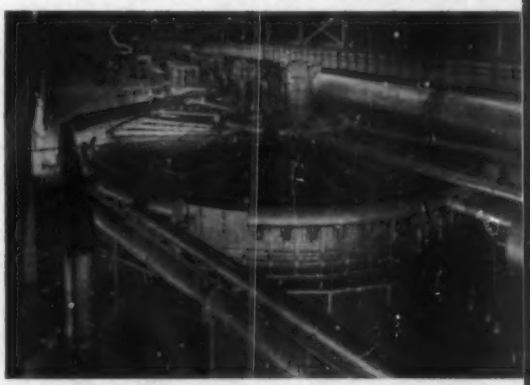
Inquiries about Iranian oil must be addressed to the Chairman of the Board of Directors, National Iranian Oil Company, 179 France Avenue, Tehran, Iran — if they are to receive official recognition, the company announced. NIOC is the sole petroleum agency in that country, and all proposals and requests for information should be directed to it.



Tubing stretch mill, Youngstown, Ohio. Electronically controlled mill to be completed during second quarter of 1958 . . . will provide increased production for Tubing comparable to our increased capacity for Casing. Both Upset Finishing Mill and this facility will greatly augment our existing No. 1 and No. 2 Seamless Mills in Youngstown. Photo shows mill building under construction.

NEW MILLS FOR BIGGER MARKETS

Two years ago, ground was broken for our three new seamless Pipe facilities. The express purpose of this massive expansion program was to make YOUNGSTOWN'S production capacity and seamless pipe product mix conform to the future needs of the Oil and Gas Industries. These seamless pipe facilities are now integrated with your demands. This means you can look to YOUNGSTOWN for a full line of Oil Country Tubular Goods without limitations as to size, grade or finish in Drill Pipe, Casing, Tubing and Line Pipe!



No. 3 seamless mill, Indiana Harbor, Indiana. Fully automated, ultra modern mill . . . began operating September 30. Contains world's largest Rotary Billet Heating Furnace . . . adds to our over-all capacity in both alloy and carbon casing. Offers API casing in sizes 4½", 5", 5½" and 7", in grades H-40, J-55, N-80, in ranges 2 and 3 . . . plus line pipe in sizes 4½", 5⅝" and 6⅝" O.D. in grades A, B, X-42, A106, A53 in single and double random lengths. Photo shows Rotary Furnace in foreground.

QUALITY YOUNGSTOWN SERVICE

YOUNGSTOWN
SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steels
Youngstown, Ohio

Upset finishing mill, Youngstown, Ohio. Also a fully automated mill began operations September 15. Contains a pair of automatic upsetters with attendant furnaces plus a full-length normalizing furnace for highest quality control of all products. This mill adds to our capacity for Drill Pipe in grades D, E, x-95 and in Upset Casing (Speedtite). Photo shows upsetter and control panel in foreground, normalizing furnace in left rear.

HIGHLIGHTS—2

Digest of News and Comments

Crude prices ripple downward, despite protests of producer groups and threats of government investigations. Postings are down in scattered areas in three oil producing regions.

On the Gulf Coast and in southwest Texas, Southern Minerals trimmed 10 cents a bbl from its price.

Sohio knocked 15 cents from the going price in the Tri-State area of Illinois, Indiana, and western Kentucky; this action was followed promptly by similar action of six other buyers, including Ashland, Aurora, Louden, R. J. and Rock Island.

TIPRO has asked that the government look into the Tri-State cut, which the organization claimed could have widespread recurrences that would "render the entire imports stabilization program meaningless."

Union of California shook the stability of the new Four Corners crude market by offering 25 cents per bbl less than Shell and Stancal.

★ ★ ★

Italian import duties have been dropped from all oil and gas equipment entering that country unless they can be purchased from manufacturers within its borders. The new regulation grants free entry for many materials and equipment used in drilling, exploration, and in pipeline activities. Refining equipment was not included in the exemption, the Italian government has announced. Applications for free entry are now being made to the Ministry of Industry and Commerce, General Direction of Mines. Most drilling and pipeline operations are in the hands of ENI, state company; refining is conducted by outside interests.

★ ★ ★

Continued oil demand slump — both export and domestic — during the past three months will alter market forecasts for the first quarter of this year, IPAA indicates. Domestic consumption in the September-November quarter averaged 8,590,000 bbl daily — one percent less than same months of 1956 and only two percent above the same 1955 quarter. Oil exports during November were off 31.5 percent from that of 1956, abnormally high because of the Suez crisis. IPAA says its previous estimates for the first quarter of this year may be on the high side.

★ ★ ★

A $500,000 allocation by Esso Education Foundation, first in a three-year $1.5 million program, has been made to 84 privately supported colleges and universities. The grant is made in the interest of stimulating teaching of science and engineering on all school levels. Some $184,000 went to aid improvement of teaching at the elementary and secondary school level.

★ ★ ★

Initial attempts to unionize West Texas well servicing and drilling employees have failed, but organizers claim the setbacks are only temporary. Personnel of two Odessa well servicing companies (PLB and Williamson) rejected representation by the International Union of Operating Engineers by large margins in December elections. Union requests are now pending for several Permian Basin drilling contractors and the union claims it will be accepted. Many observers in the area, however, say that unionization of servicing employees would have been easier.

★ ★ ★

Three billionth barrel of oil in Saudi Arabia was produced by Arabian American Oil Company early last month. Arabia is the second country in the Middle East and fifth in the world posting such a record (others are Iran, U. S., Venezuela, and Russia). Oil was discovered in Arabia in 1938; it produced the first billion barrels by January 1952, the second billion barrels in February 1955.

★ ★ ★

Crude prices can be expected to rise "in the not-too-distant future," claim ACS speakers N. R. Adams and Ralph Kersten, Universal Oil Products Company. Their thoughts, expressed at the recent Southwest regional meeting of the American Chemical Society, are particularly significant in light of recent price cuts. The pair suggested that the question at hand is not "Will crude prices go up?", but "When?".

Annual Index for 1957
The Petroleum Engineer

The editorial index of articles published in all editions of *The Petroleum Engineer* during 1957 is now available.

Subscribers wishing to receive a free copy should write to this magazine, P. O. Box 1589, Dallas, Texas.

Please state company position and don't forget to include your address.

Meetings

Jan. 16-18—Association of Oilwell Servicing Contractors, 2nd annual convention, Baker Hotel, Dallas, Texas.

Jan. 19-22—Pipe Line Contractors Association, 10th annual convention, Boca Raton Hotel and Club, Boca Raton, Florida.

Jan. 31—Natural Gasoline Association of America, regional meeting, Skirvin Hotel, Oklahoma City, Oklahoma.

Feb. 2-8—ASTM Committee D-2, petroleum products and lubricants meeting, Rice Hotel, Houston, Texas.

Feb. 12-14—National Association of Corrosion Engineers, Tulsa section, 9th annual Tulsa Corrosion Short Course for Pipeliners, Mayo Hotel, Tulsa, Oklahoma.

Feb. 13-15—National Society of Professional Engineers, spring meeting, Michigan State University, East Lansing, Michigan.

Feb. 16-20—AIME, annual meeting, Hotel Statler and Hotel Sheraton-McAlpin, New York City.

Feb. 26-28—American Petroleum Institute, Division of Production, Southern district meeting, Shamrock-Hilton Hotel, Houston, Texas.

Feb. 28—Natural Gasoline Association of America, Permian Basin regional, Lincoln Hotel, Odessa, Texas.

Mar. 3-4—Society of Petroleum Engineers of AIME, 4th annual joint meeting of Rocky Mountain petroleum sections, Cosmopolitan Hotel, Denver, Colorado.

Mar. 5-6—Gas Conditioning, short course, sponsored by the schools of petroleum and gas engineering, The University of Oklahoma, Norman, Oklahoma.

Mar. 7-8—American Association of Petroleum Geologists, Pacific section annual meeting, Ambassador Hotel, Los Angeles, California.

Mar. 10-13—American Association of Petroleum Geologists — Society of Economic Paleontologists and Mineralogists, annual meeting, Biltmore Hotel, Los Angeles, California.

Mar. 12-14—API Division of Production, Southwestern district meeting, Hotel Texas, Fort Worth, Texas.

Mar. 17-21—National Association of Corrosion Engineers, 14th annual conference, Civic Auditorium, San Francisco, California.

Mar. 20-21—AIME, Petroleum Production and Reservoir Engineering conference, Mid-Continent local section, Mayo Hotel, Tulsa, Oklahoma.

Mar. 24-26—Midwest Gas Association meeting, Broadmoor Hotel, Colorado Springs, Colorado.

Mar. 31-Apr. 2—API Division of Transportation, annual pipeline conference, Jung Hotel, New Orleans, Louisiana.

Apr. 1-3—Corrosion Control, short course, sponsored by the Oklahoma City chapter of National Association of Corrosion Engineers and the College of Engineering, University of Oklahoma, Norman, Oklahoma.

Apr. 9-11—API Division of Production, Mid-Continent district meeting, Biltmore Hotel, Oklahoma City, Oklahoma.

Apr. 12-17—American Chemical Society, 133rd national meeting, San Francisco, California, including Pacific Chemical Exposition, Civic Center, Exhibition Hall, San Francisco, California.

Apr. 16-18—Natural Gasoline Association of America, annual convention, Baker and Adolphus hotels, Dallas, Texas.

Apr. 17-18—Society of Petroleum Engineers of AIME, Louisiana, Arkansas, East Texas and Mississippi petroleum sections, gas technology symposium, Shreveport, Louisiana.

Apr. 20-23—American Institute of Chemical Engineers, regional meeting, Sheraton-Mt. Royal Hotel, Montreal, Canada.

Apr. 21-23—API, Division of Production, Rocky Mountain district, Cosmopolitan Hotel, Denver, Colorado.

Good Wells Make Good News

January, 1958

ACIDIZING has long been a good way to stimulate production from zones of high solubility. With Dowell-proved addition agents, acid is giving faster payouts in more fields than ever before. Here are some recent examples of successful Dowell acid treatments.

- **Meade County, Kansas** (New Gas Well): This well was completed in the Mississippi lime (90-95 per cent soluble) at 6470 to 6494 feet. Before treatment, it tested 3.5 mmcfd open flow. *After treatment with 10,000 gallons of Retarded Acid, injected down casing at 28.5 bpm, well tested 30 mmcfd open flow.*

- **Alberta, Canada** (Old Well): This oil well was completed through two sets of perforations in the Elkton member of the Mississippian lime at about 9100 feet. Production had declined to the point where the well would flow only one or two days—then die for three or four. Dowell recommended a combination acid treatment designed to get deep penetration, using 5000 gallons of Retarded Acid ahead of 15,000 gallons of the acid-oil emulsion used in Acid Petrofrac®. The treatment was performed down casing to reduce treating pressure. Average injection rate was 6 bpm at 3300 psi. *After treatment the well tested 440 bopd flowing on three consecutive tests.*

- **Crawford County, Illinois** (New Oil Well): Completed in Aux Vases sandy lime, 1514 to 1532 feet open hole. Initial production 50 bopd. Acid Petrofrac was selected as the treatment. A 500-gallon spearhead of regular Dowell inhibited acid with surface tension reducing agents, preceded 3000 gallons of acid-oil emulsion with 3000 pounds of sand down 4½-inch casing, 12 bpm at 1400 psi. *After treatment, well was put on pump at 140 bopd—much better production than other wells in the area.*

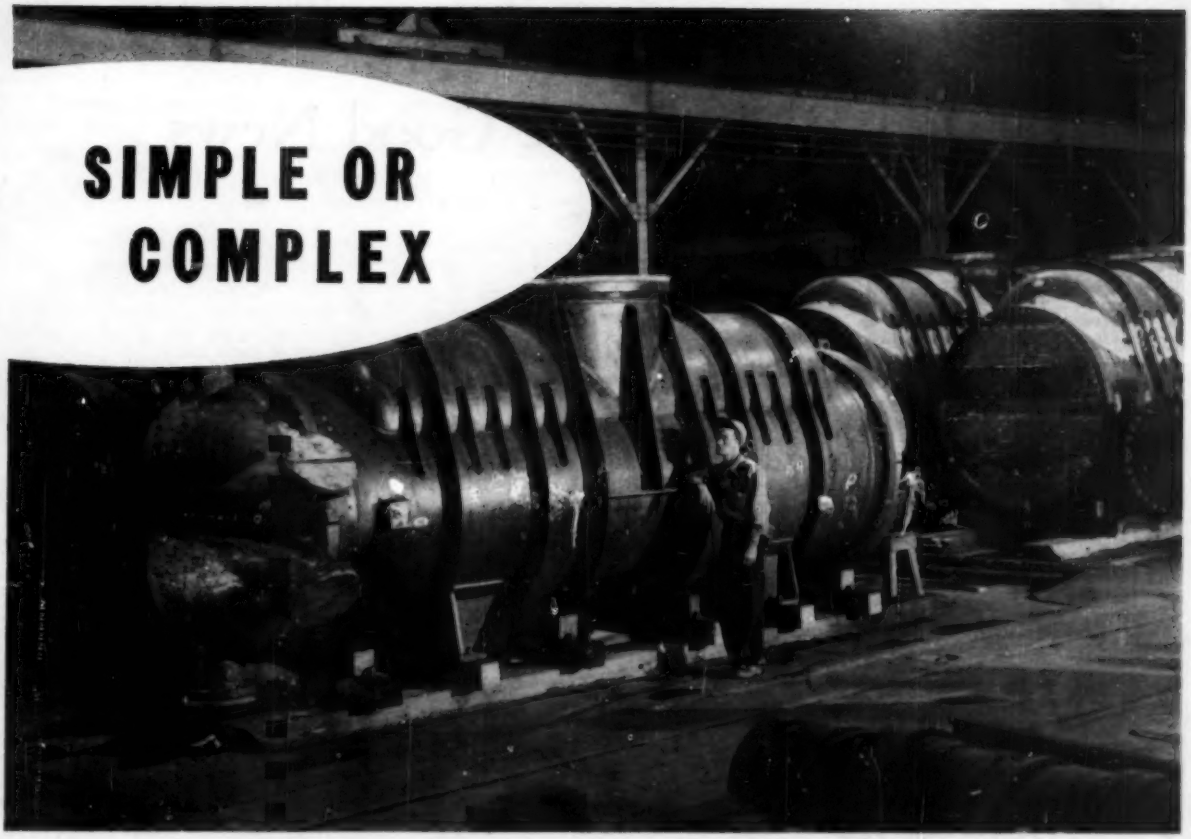
- **Lea County, New Mexico** (New Well): This oil well would not flow when completed in the flashy Kemnitz Wolfcamp lime at 10,600 feet. Treatments performed on other wells in this field indicated regular acid would not give desired results because of the fast reaction rate of the acid with the formation. Dowell engineers recommended a combination treatment using 1000 gallons of Mud Acid, 3000 gallons of Retarded Acid and finally 15,000 gallons of the acid-oil emulsion used in Acid Petrofrac®. Since each acid has a different reaction time, this treatment was designed to extend the drainage area of the well by getting deep penetration. *After treatment the well tested 275 bopd flowing.*

Whether your well responds best to regular acid, thickened acid or an acid-oil emulsion your Dowell Engineer can tailor a treatment to the requirements of your well. For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

Services for the oil industry DOWELL

A Service Subsidiary of The Dow Chemical Company

SIMPLE OR COMPLEX



EFCO does it right

No job is too complicated for Efco's heat-transfer specialists. One reason that Efco does it *right* is its many years of experience in designing and fabricating heat-exchangers for the wide range of temperatures and pressures represented by ethylene plants and platinum catalyst reforming units. We are recognized specialists in handling all grades of carbon, alloy, and stainless steels, nickel, aluminum, and special low-temperature materials.

EFCO'S FOUR POINT PROGRAM PROVIDES:

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INDUSTRY LEADERS
Preview 1958

- *U. S. Domestic Demand Will Increase 3%*
- *Other Free World Needs May Rise 8 to 10%*
- *Capital Outlays Will Almost Equal 1957*
- *Research Plans Call for Substantial Increase*
- *Foreign Concession Costs Will Level Off*
- *Voluntary Imports Program Shows Promise*
- *Legislative Has Depressive Influence*
- *Federal Highway Program Finally Begins*

Ernestine Adams

STANDING on the corner of January 1 we look up 1958 Street. As the future usually does, it looks interesting and intriguing.

The whole year may not be a great deal better economically than 1957 but there is one difference. Instead of the decline we reluctantly tread the last of 1957, the new year seems to have a more exhilarating climb for its second half.

This is sort of a concensus of courageous guessers.

As you know, you can get a straight-out prediction for economic conditions in 1985 or 1970. You can even get one only slightly hedged for 1960. (A dinger—they say.) But try to get a positive outlook for 1958!

The reason is easy to find. The general trend hasn't changed since 1776. The U. S. economy is a gigantic long-term success. But it does have occasional slowdowns—fortunately for its stability. These dips or recessions often generate more efficiency than periods of prosperity by giving business a chance to set its sights and improve its steering.

As you've already read, no doubt, the majority of professional economists see ahead a half year of slack with a pick-up beginning around mid-year of 1958.

Heads of U. S. oil companies generally see the bright side for 1958. U. S. demand (including exports) increased approximately 3 percent in 1957 despite the downtrend in the second half.

As Robert E. Wilson, board chairman of Standard Oil (Indiana) explains, the 3 percent increase is an undramatic figure that tends "to hide a very hectic year."

DR. WILSON: "In the first four months, largely due to the Suez crisis, total demand was up 8.2 percent, and both domestic production and refinery runs attained new high records in making up for the sharp curtailment of Middle East crude and products.

"In the seven months beginning with May, demand has shown a *decrease* of about 0.5 percent, with only gasoline showing a slight increase. Refinery runs, however, remained too high until recent weeks,* product stocks built up to excessive levels, and the inevitable happened in an industry as competitive as ours—product prices steadily weakened until many of them

Miss Adams is Management Editor.

*Statement made December 10, 1957.

approached the levels which prevailed before the crude price increase.

"Imports came back with a bang in June, July, and August, and domestic crude production was cut back to a level well below a year ago, with only 12 or 13 days per month allowable in Texas.

"Domestic demand next year should again show an increase, probably of about 3 percent, given normal weather, although a combination of a warm winter and an industrial slump might make next year one of the rare years which would not show an increase."

The petroleum industry may not have met the drastic changes in 1957 perfectly smoothly but it did an amazing job. L. F. McCollum, Conoco president, points out the range of demands made upon the industry.

MR. McCOLLUM: "The year 1957 was one of great challenge to the U. S. petroleum industry. Early in the year, the industry was called upon to meet world-wide deficiencies in the supply of petroleum and its products caused by the Suez crisis. Within the space of a few short months, domestic crude oil production was boosted to an all-time high of 7.8 million barrels daily. In March, 1957, the U. S. oil industry was shipping over a million barrels a day overseas, thus enabling Europe to receive about 90 percent of its normal petroleum requirements.

"The problem of supplying oil to Europe had scarcely been met and solved when the industry was confronted with a new and completely different challenge. In the late spring of 1957 when the emergency shipments abroad were no longer required, supply had to be cut sharply to match domestic demand. This problem was accentuated by the fact that during the second quarter of the year domestic demand was 2 percent below the comparable 1956 level. In addition, domestic operations had to be adjusted to accommodate resumption of the inflow of large volumes of foreign crude into this country.

"An industry as large as ours, possessing great momentum, cannot be turned around on a dime. And yet, crude oil production was curtailed from the all-time high of 7.8 million barrels a day in March to 6.8 million barrels a day in August. Refinery runs by the middle of the fourth quarter were cut below 1956 levels. Inventories of crude oil and the four major refined products, which in June were 9.1 percent above their 1956 level, were steadily reduced until in mid-November, they were less than 5 percent above their 1956 level.

"The year 1958 promises to be another year of challenge, although the required adjustments in operations are not likely to be as sudden or as drastic as in 1957. General business activity has been leveling off and moderate down trends are becoming increasingly evident in various segments of our economy. Domestic demand for petroleum products will probably be up 3 percent or less in the year ahead."

Jake L. Hamon, former board chairman of American Petroleum Institute and prominent independent, puts the problem of 1958 succinctly — we need less supply and more demand.

Robert E. Wilson
Chairman of the Board
Standard Oil Company

Jake L. Hamon
Independent
Dallas, Texas

S. B. Mosher
President
Signal Oil & Gas Company

L. F. McCollum
President
Continental Oil Company

B. B. Jennings
Chairman of the Board
Socony Mobil Oil Company

H. S. M. Burns
President, Shell Oil
API Chairman of Board

R. G. Follis
Chairman of the Board
Standard Oil of California

MR. HAMON: "The outlook for the oil industry for 1958 will depend on two factors, namely, (1) substantial reductions must be made in our above-ground inventory, and (2) it is necessary for us to have our customary increase in consumption.

"As you know, we had practically no increase in demand in 1957 and the problem is, will the forecasted increases in 1958 materialize."

Normal increases in demand would be enough to solve inventory problems, according to Samuel B. Mosher, president of an aggressive small company, Signal Oil and Gas Company.

MR. MOSHER: "The petroleum industry's 1957 inventory problems stand a good chance of showing improvement in 1958. A resumption of consumer demand more in line with the year-to-year percentage increases attained in those years immediately preceding 1957 could be a primary factor in reducing inventories. After all, population is increasing and per capita use of oil and gas has also been increasing."

Chairman R. G. Follis, Standard of California, saw the slowing of petroleum increases as only temporary.

MR. FOLLIS: "During 1957, tempering of business activity in North America and Europe was reflected in a moderating of the rate of growth for petroleum demand, both at home and abroad.

"Domestic demand in the U. S. in 1957 averaged an estimated 8.8 million barrels daily of demand, 0.8 percent greater than in 1956. Some over-supply existed in the latter half of the year but, as the results of curtailment of imports and domestic production, inventories are now improving materially.

"In 1958, it is anticipated that U. S. oil requirements will average close to 9.1 million barrels daily, or nearly 3 percent higher than in 1957. Principal factors supporting this forecast for increased consumption are the country's long-term population growth trend and the expectation that winter temperatures, warmer than usual in 1957, will return to a more normal pattern."

B. Brewster Jennings, board chairman, Socony Mobil, thinks the outlook is dim for increases.

MR. JENNINGS: "The oil industry enters the New Year with its outlook less bright than in most recent years. We at Socony Mobil look for an increase in domestic demand in 1958 of only 2.6 percent, and total demand for U. S. crude oil and products no higher than this year."

Sun Oil's president, Robert G. Dunlop, gives a careful analysis of the past year.

MR. DUNLOP: "While operations were satisfactory, Sun Oil Company views the last six months with disappointment and the year ahead with an unusual awareness of changing economic conditions. With petroleum demand registering the lowest rate of increase since 1949, the indutsry ended the year with high inventories and sales that failed to come up to expectations.

"For the first quarter, the Suez crisis served as an artificial stimulus to total demand. But when it eased, the industry felt the full effects of the general decrease in the demand rate, which will probably approach 2 percent above 1956. This compares with a 4.1 percent rate of increase in 1956 over 1955, and with 8.8 percent in 1955 over 1954.

"A combination of factors caused this situation. One was fewer auto registrations than expected, which affected motor fuel sales; another was the warmer than normal winter and spring, which reduced sales of light burning oils, and a third was the easing of industrial activity, which slowed sales of petroleum products.

"The general result of this slackened demand was a softening of prices, which, accompanied by increasing unit costs, reduced earlier gains. The result, for the most part, was a lower rate of net profits than expected."

More "plateau" than dip is the summary of H. S. M. Burns, American Petroleum Institute chairman and president of Shell Oil Company.

MR. BURNS: "Since most oil men who are asked to make predictions have access to about the same kind of information, I suspect most of us will come up with about the same comment: Things are not as good as we predicted this time last year, but there is nothing to justify any doleful forebodings.

"The industry is on a plateau, like those it has experienced several times in the last 30 years. The industry's capacity to provide products once more outruns the nation's demand for them. The system has consequently developed some slack. But that slack can come in handy with a break or two in the right direction.

"We expect domestic demand, industry-wide, to be up about 3 percent in 1958. We expect total demand to show no gain at all because of a drop in exports, which were quite high early this year on account of Suez. And we base these estimates on the assumption that we will have a normally cold winter — a winter 10 percent warmer than normal could cut demand for heating oils enough to wipe out most of the anticipated gain for all oils in a poor-gain year like 1957.

"But the long term prospects are for continued growth because the prospects for the nation are for greater population and wider use of machines that need oil for energy."

OIL IMPORTS took most of the blame for the domestic slump that began about mid-year. Some independents seemed to feel that cutting imports drastically would solve all their problems. Large importers shipped in oil as if their competition was their own domestic production.

There was hardly a spot in the wide range of the imports dispute where more than two persons could stand in agreement. But by open discussion and courageous leadership and by sane political action, a plan was foregd and appears to be wheeling along —roughly but pretty effectively.

If this voluntary plan is successful in setting a respected definition on the term "supplement but not supplant" it will be an industry triumph. We hail the

industry for meeting shortages in crises of war and disturbance but facing up to the imports problem—where every one has a good argument against any definite proposal—is economic statesmanship much more difficult to achieve.

The end of the controversy isn't in sight and isn't likely to be. But in times of oversupply an approximate agreement of the majority is high success. In the opinion of J. R. Parten, of Woodley Petroleum Company, the situation is improved.

MR. PARTEN: "Present indications are that the results of our operations in 1958 should be slightly improved over 1957. It now appears that the volume of foreign imports will be held to reasonable levels and that the necessity for any substantial reduction in domestic allowables will not materialize. There should be an improved balance between supply and demand which should result in satisfactory profit levels for the industry generally."

In October for the first time imports dropped below the government's recommended level, according to Captain Matthew V. Carson, Jr., shrewd and amiable administrator of the voluntary oil import program. This is heartening progress. W. C. Norman, president of Colorado Oil and Gas Corporation, wants domestic producers to fill increase in demand.

MR. NORMAN: "We anticipate that early 1958 will be a belt-tightening period as an attempt is made to solve the principal problem of bringing supply and demand into balance. It is believed that the proposed schedule of imports as set forth by Captain Carson's office will be a forward step in the attainment of this balance which is so important to the independent producer and refiner. At the same time, the domestic producer must be allowed to fill any void which will be created by next year's increased demand.

"If growth in our domestic demand is allowed to be supplied first by domestic production, supplemented with imports for any deficiencies in such supply, an important step forward will be taken for the benefit of the independent producer as well as the good of the industry and the country as a whole."

Bishop Oil Company's president, William Wallace Mein, Jr., has little confidence in limiting imports.

MR. MEIN: "We expect demand for petroleum products to gain from 2 to 5 percent in 1958. However, production will probably decline in the United States and Canada because of continued oil imports from overseas. This will seriously affect the independent producers in both countries and make available less money for exploration work, which will lead to the development of fewer new oilfields and eventually affect national security and economy.

"Continued heavy importation of overseas oil already has led to severe restrictions of production in the United States and Canada to prevent a market oversupply. Serious thought should be given to increasing the tariff as it applies to oil from overseas."

FOREIGN OPERATIONS are on the other side of the imports situation.

Higher costs of finding oil in the U. S. combined with some state production schedules set at 50 percent and below sparked the biggest stake in foreign operations ever made by U. S. companies in 1957.

Smaller companies ventured abroad for the first time. Risks were greater but rewards more promising. If you hit you didn't have to wait so long for the payout. It was worth a try.

MR. NORMAN: "It is inevitable with discovery rates declining in this country that we must look abroad to high potential, petroliferous areas where there is continued promise of new major discoveries. Such investments abroad take increasing amounts of capital for which in 1958 it appears the independent must look principally to his own cash generation. For 1958, our total capital expenditures will not appreciably increase from the 1957 figure of $10,000,000; but it is planned that some 25 percent of this will be spent in Canada and Alaska."

MR. DUNLOP: "During 1958 we shall continue our foreign exploration, particularly in Venezuela, in an effort to achieve a more satisfactory footing with our competitors in the cost of our raw materials."

On the whole, however, probably there will be less money going into foreign operations from U. S. companies in 1958. Several are in the position of White Eagle Oil Company, as explained by Walter H. Helmerich III, executive vice president:

MR. HELMERICH: "White Eagle's 1958 prospects are good. The company's gains, however, will come mostly in digesting last year's capital expenditures, which exceeded by a hundred percent those of any previous year. In 1957 half of our capital expenditure budget was diverted to foreign exploration and foreign contracting.

"White Eagle has a position in Cuba, the Philippines, and Bolivia, and is in the process of filing in other areas. Helmerich & Payne, C. A. is now actively expanding in Venezuela with ten deep rigs projected for 1958. Although as contractors we will continue to grow domestically we are prepared also to send men and equipment to any spot on the globe. We feel the big gains in 1958 will be made in foreign operations."

Thus, high 1957 foreign capitalization is one reason for a fall-off in 1958. There are special cases, too. For instance, 1956 and 1957 each saw about a third of a billion dollars* paid for Venezuelan concessions alone and this probably will not be repeated in 1958.

Although capital for foreign operations may be less that in 1957, it will still be considerable. Recent successful drilling in Venezuela and the Sahara is one strong magnet for world-wide wildcatters. Companies with new concessions become more eager to learn what they've bought.

*See "Who Got New Concessions and What They Cost," The Petroleum Engineer, November, 1957, Page E-6. Most of the $685 million total came from U. S. companies.

Canada expects an oil products consumption "increase of 5.1% over 1957."

Robert G. Dunlop
President
Sun Oil Company

J. R. Parton
President
Woodley Petroleum Company

Wm. Wallace Mein, Jr.
President
Bishop Oil Company

W. H. Helmerick, III
Executive Vice President
White Eagle Oil Company

A. C. Long
Chairman of Board
The Texas Company

Richard T. Lyons
President
Union Oil & Gas of Louisiana

M. S. Beringer
President
British American Oil Company, Ltd.

Another significant fact, which will be an incentive to develop oil outside the United States, is that markets are increasing faster in foreign countries than in the United States. In recent years these increases have run about 11 percent annually.

A. C. Long, The Texas Company chairman, and Mr. Follis of Standard of California make predictions not far apart concerning expansion of demand outside the United States.

MR. LONG: "We anticipate a good year in 1958, with consumption in the United States up about 3 percent over 1957 and in the free foreign world about 7 to 8 percent."

MR. FOLLIS: "Abroad, the lingering effects of the Suez Crisis and reduced rates of business growth in certain areas slowed free foreign demand in 1957, to about 8 percent over 1956. In contrast to this, we foresee an average free foreign demand of about 8.0 million barrels daily in 1958, an increase of about 10 percent over 1957."

Canada, also, is in a special position. M. S. Beringer, British-American president, gives an excellent all-round review of prospects there:

MR. BERINGER: "Historically, the growth in demand for petroleum products has been continuous, with economic conditions affecting only the rate of growth.

"With the Canadian population reaching the 17 million mark in 1958, demand for petroleum products will continue to grow, probably not at the rapid pace experienced over the past few years but at a more normal rate. At least 287 million barrels of petroleum products are forecast for consumption during 1958, an increase of 5.1 percent over 1957. Crude processed at refineries is expected to reach 265.5 million barrels, with refinery capacity moving up to 785,350 bbl a day, an increase of 7 and 10.8 percent respectively.

"Construction of natural gas gathering systems and main trunk lines will continue to be a major factor during 1958, with continued progress in construction of the Trans-Canada Natural Gas Line through to Toronto and extension of the present gas system at Toronto through to Montreal. Crude oil production in Western Canada will be governed by demand, in which exports are a major factor.

"We anticipate an increase in crude production of 3.5 percent over 1957, equivalent to 203 million barrels. Of this total, we feel exports will be in the neighborhood of 58.6 million barrels.

"New oil field discoveries and extensions to present oil fields are adding to our gross reserves at the average rate of 236 million barrels annually, so that Canada's ability to produce crude oil is much greater than our markets. It is evident that time is the major factor in narrowing the gap between potential supply and demand. California and Washington afford the greatest opportunity for further increasing our crude markets.

"Since this matter of crude potential and markets is a pressing one, there would seem very little doubt that

exploration and development activity will show a decrease in 1958 compared with 1957. We anticipate total wells drilled during 1958 will be not more than 2,500 across Canada."

LEGISLATIVE HOTSPOTS are named by several leaders as the industry's greatest problem. President Richard T. Lyons of Union Oil and Gas Corporation of Louisiana, finds trouble in Federal Power Commission regulation of producers' gas prices on a public utility rate base concept.

MR. LYONS: "Hearings pertaining to this type of regulation are extremely time-consuming, expensive and indeterminate, with the producer unable to predict his future financial picture. As a result, the gas producer must hedge in his budgeting and operate on a restricted basis until he can find out what his income is going to be, which will be sometime down the line."

MR. DUNLOP: "One uncertain cloud on the horizon is the continued federal utility regulation of natural gas production, which restricts managerial freedom and the free interplay of the market. It is to be hoped Congress will enact pending legislation to remedy that situation in the interest of gas consumers as well as the industry."

J. C. Donnell II, president of The Ohio Oil Company, includes other political action in his statement.

MR. DONNELL: "Our biggest problem in 1958 is not in making necessary economic adjustments but in warding off political encroachments that threaten every phase of the petroleum industry's operations.

"While it may not be feasible at this time to regain our traditional freedoms in natural gas production, we should unite in support of the Harris Bill which would substitute a practical basis for regulating such operations. The present public-utility-type of control is untenable in an industry that has none of the earmarks of a public utility.

"Our pipeline operations are coming under direct attack. The investigation by the Department of Justice on the effects of multiple ownership of pipelines may lead to action which could seriously disrupt the future growth of this phase of our industry. Likewise, the same Department's recent motions in conjunction with the Pipeline Consent Decree pose serious threats to the very existence of pipeline transportation. These developments, when joined with the Celler committee's investigations into consent decrees, could seriously impede our ability to adjust to economic problems.

"In refining and marketing, we must contend with the perennial efforts to divorce these segments from the industry and, in addition, are faced with the very serious implications of S-11. Such 'straight-jackets' can harm us more than any economic disruptions which may develop.

"Finally, we should not lose sight of the fact that the depletion provision will probably be under pressure during the next session of Congress. Any reduction of the present rate would compound the economic problems to be encountered in a business decline and, in addition, would jeopardize national security.

"The current year promises to be crucial for the petroleum industry. We must always be prepared to adjust to changes in the economic climate — but doubly alert to protect our freedom to operate in a competitive manner."

J. C. Donnell, II
President
The Ohio Oil Company

Paul E. Taliaferro
Executive Vice President
Sunray Mid-Continent Oil Company

Gordon Simpson
President
General American of Texas and
Independent Petroleum
Association of America

P. C. Spencer
President
Sinclair Oil Corporation

C. H. Lyons
Lyons & Logan
President
Mid-Continent Oil & Gas Association

Political obstacles are cited by Paul E. Taliaferro, executive vice president, Sunray Mid-Continent Oil.

MR. TALIAFERRO: "Man-made obstacles pose a graver threat to the oil industry in the coming year and the years ahead than the barriers which Nature has placed in the oilman's way.

"Specifically, some of these man-made problems include federal control over natural gas; constant harass-

ment of the industry through governmental investigations; repeated attacks on percentage depletion; threat of restrictive legislation by the government, and the divided front within the industry itself on issues such as oil imports.

"Long accustomed to battling the barriers of Nature, oilmen still must face such obstacles as the occurrence of oil in out-of-the-way places; the need of drilling wells to much greater depths; the problem of finding and developing oil in advance of actual need; and the high cost of carrying this reserve producing capacity."

Another harassing political move is the claim made by the Department of Justice to all lands beyond the three-mile limit in the Gulf of Mexico. It is too space-consuming to go into the long story of politics and oil offshore. Result from continued uncertainty means the oil companies leasing the Texas and part of Louisiana offshore areas between three miles and three leagues (10½ miles) at present have two landlords who are in dispute — not an enviable position.

Ira H. Cram, senior vice president, Continental Oil, made an illuminating statement before a Congressional sub-committee on the situation.

MR. CRAM: "The industry has never plowed so much money into a given area over a period of 12 years and at the end of the period had so little to show for its efforts in proved reserves and revenue."

He gave these figures as evidence: $2 billion spent to develop offshore production; $400 million revenue; $1.6 billion remain to be recouped. The $2 billion does not include overhead, research, and expenses other than exploratory and drilling expenses and continued losses since expenditures are still double revenue.

Problems enumerated by Judge Gordon Simpson, president of IPAA and of General American Oil Company, come under legislation.

JUDGE SIMPSON: "Our company only faces those problems which are currently common to others in the industry, problems which are not especially new but which have continually tended to protrude themselves in varying aspects.

"These include excessive imports of foreign oil and products; attacks on the basic income tax treatment which the Congress has extended to oil producers for over 31 years, manifestly extended on the assumption that this treatment has been fair to both the public and the producers; and efforts by gas producers to escape the massive burden of utility-type regulation by the Federal Power Commission."

SOFT PRICES were frequently named as a problem riding into 1958. Some saw no change in sight.

MR. McCOLLUM: "Price levels for refined products are low and show no great promise of strengthening in the immediate future. The near-term outlook for oil company earnings is not appreciably better than in the third quarter of 1957 when a group of major companies registered a 5 percent decline in profits below 1956 levels."

Frank H. Dunn, Wilcox Oil Company president, thinks the refined products market one of three problems. (State proration limitations and continued inflation were others.)

MR. DUNN: "The softness of the refined products market resulting from over-production, excessive inventories ,and, above all, increased imports of foreign crude oil" is one of the chief problems of domestic oil producers.

President P. C. Spencer of Sinclair believes conditions can be helped by industry effort in 1958.

MR. SPENCER: "Once again, the oil industry is contending with the problem of inadequate product prices, high costs and over-supply. Only hard work and realistic thinking will bring about a better relationship between what the industry must pay out and what it receives. This hard work and realistic thinking, together with a re-emergence of the industry's long-term demand growth, should improve conditions through the coming year."

Stated one of the smaller integrated companies: "In our manufacture of petroleum products the main problem is a stabilized price. At the first of 1957 the price of crude oil was increased, labor costs have increased as well as costs of materials and supplies. During the year 1957 the prices of refined products were very soft. We believe this situation is primarily attributable to the low cost of foreign crude imported to the United States which permits the manufacturers to sell their products at prices below those who refine domestic crude.

Signal's president backs the cause of producers.

MR. MOSHER: "Regardless of the so-called squeeze on refiners' margins, in light of the many studies indicating sharply rising costs for finding new crude oil reserves, present crude prices are low. This has to be recognized."

Another comment showed the effect of soft prices on earnings.

DR. WILSON: "Combined earnings of the 30 largest companies during 1957 showed a gain of 18.5 percent in the first quarter, 14.9 percent in the second, and a loss of 3.7 percent in the third. The fourth quarter will probably be moderately down, but earnings for the year well above 1956.

"Some industries might wonder what we are complaining about, but in view of the heavy capital expenditures of past and future years, earnings really are inadequate, especially for those engaged primarily in refining and marketing. On the East Coast the combination of excessive product stocks, low tanker rates, and competition with products from foreign crude, has been especially severe. In the Middle West stocks are not excessive, but we are not immune to the effects of imports. The adverse trend of earnings seems likely to extend into the early part of next year, when comparisons will be made against the period of the Suez crisis.

The sobering report of the 1957 third quarter called

for soul-searching as well as for efficiency experts.

Fifty-six companies in our 9-month survey* increased sales and other revenues in July, August, and September by $1 billion or 16 percent above 1956 for that period. At the same time earnings of the same companies dropped 2 percent below 1956. In other words, the industry managed to lose money on that extra billion dollars worth of sales and other income.

Management began to look at its books. You can't keep the oil industry in business with the less than 9 percent profit margin that showed up in the 1957 third quarter and management knows it.

SINCE we've been playing the voice of the future with the help of preliminary estimates of capital expenditures by 20-some oil companies, we have never had to consider such a range of differences in plans. Two faint trends show up. One is an increase in research funds and the other a leveling off in foreign investments. Yet even these have decided exceptions. One company, for instance, plans a 32 percent increase over 1957 for capitalization abroad.

Outlook for all U. S. business and industry indicates a slow down in capital spending. Most comments judged capital expenditures would be about the same as 1957.

MR. HAMON: "I would estimate that the industry will spend as much money in 1958 as it did in 1957. That seems to be the program of most people that I have talked to and that is the program that I have set up for my own operations next year."

Jersey Standard, largest oil company, with capital expenditures of $1.4 billion dollars last year, expects a similar budget in 1958. Because of present stock sale, no statement was made but the prospectus for the stock read:

"For the year 1957 total outlays are estimated at $1,400 million, distributed by function approximately as follows: producing 51 percent; refining 25 percent; marketing 13 percent; transportation and others 11 percent... The total of these outlays for 1958 is expected to be of the same general order of magnitude as for 1957 with a somewhat higher proportion of expenditures in the field of refining and a somewhat lower proportion in producing."

Most actual estimates showed programs slightly lower than 1957. There are a number of reasons, however, why capital expenditures may run higher than present conservative planning. First is the high capitalization inherent in petroleum operations. Despite the slowing of the economy in 1958, oil production was high for the year and reserves must be found to replace those consumed. Presidents of both Colorado Oil and Gas and of Shell Oil stress this.

MR. NORMAN: "A growth company in the oil and gas industry is faced continuously with the problem of finding more reserves than it produces. This means that for exploration and development purposes it must continue to generate the maximum amount of cash possible through stepped-up production as well as increased refinery sales. Increased demand and increased domestic allowables are a means to this end and for such the industry must strive."

MR. BURNS: "The industry's basic concern must be with maintaining reserves of crude oil. This year's college freshmen, who will be on the narrow side of middle age in the year 2000, will no doubt need to get all the energy they want from liquid hydrocarbons, but the responsibility for seeing that this is so lies heavily on today's oil man — and tomorrow's.

"If prevailing trends continue we will have to find a barrel and a half of new oil for every one we use. For the next decade alone we may have to drill 70,000 wells a year to maintain adequate reserves.

"Providing the money for that may be a big job. It will be easier if taxes and regulations do not discourage investment."

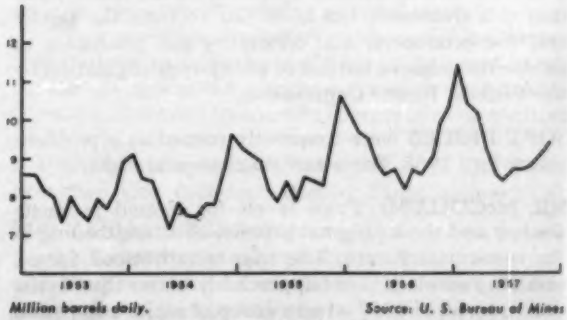
Sunray Mid-Continent's experience gives an idea of the growth of risk money that must be used to meet demand in the future.

MR. TALIAFERRO: "A requisite of continued growth is a continuous flow of risk capital. This risk capital will require capital recovered through depreciation and depletion, retained net income after taxes and dividends, and the balance from stocks, bonds or loans.

"Sunray Mid-Continent's book assets in 1926 were $1.7 million; today book assets are in excess of $530 million. In 1957, the company's capital expenditures totaled $80 million as compared with $66 million in 1956 and $53 million in 1955. Of the $80 million outlay in 1957, approximately $10 million went for expansion of refining and research facilities at the two refineries of the company's subsidiary, D-X Sunray Oil Company. Also, of 1957's capital expenditures, $11 million was earmarked for activities in Venezuela where Sunray holds a total of six concessions, in partnership with other oil companies. In Alaska, Sunray holds 113,000 acres on the Kenai Peninsula."

No let-down in capital investment is seen by these executives.

MR. MOSER: "The best estimates available predict increased capital expenditures each year into the foreseeable future, which should mean increased activity



Million barrels daily. *Source: U. S. Bureau of Mines*

Curve shows increase in U. S. demand (including export) over the last five years. Rise in 1957 is largely result of Suez Crisis. Most predictions are that 1958 U. S. demand will equal the record of 1957.

*The Petroleum Engineer, December, 1957, Page E-6.

in all divisions of the industry. Even the financial end will have more activity as capital expenditures outrun industry-generated funds and outside sources must be tapped."

MR. FOLLIS: "Worldwide, the oil industry's ability to meet continuing increased demands hinges as in past years upon the accumulation of sufficient capital to finance necessary growth. Fulfillment of capital requirements constitutes a continuing challenge that must be met if the industry is to succeed in providing the vast quantities of petroleum needed by all of the Free World now and in the future."

DR. WILSON: "The oil industry shows no sign of curtailing capital expenditures next year — the Chase Manhattan Bank survey this fall showed estimated expenditures for production up about 5 percent, for refining up about 3 percent, and for transportation and marketing up 5 percent. The slightly greater planned expenditure for production reflects the deeper drilling and other increased expenses involved in finding domestic crude oil, and probably means slightly fewer wells. The increase for refining is somewhat surprising in view of the substantial excess capacity and low refinery margins which now prevail in the industry, but most of these expenditures are doubtless directed toward modernization of refineries and attaining generally higher octane levels, rather than expansion.

"All this will necessitate new borrowings and equity capital of about one billion dollars for the domestic part of the industry, almost the same as this year. Fortunately, the industry's credit still seems to be good! The outlook for 1958 earnings is less clear but for the year as a whole they may equal 1956."

Another reason capital expenditures are not likely to be cut is that inflation will increase some costs, and may add to the estimated total. Rise in wages, which has upped costs throughout supply and service companies, as well as in petroleum companies, must be met with greater efficiency, which generally means more efficient equipment.

The third reason is more intangible and more important. The industry must face the fact it is one of a few in the U. S. that must carry a burden of production and refining excess capacity or run the danger of permanent government control. The Suez crisis—when some politicians thought the emergency was not being met — gave oil men a taste of what could happen if the industry failed to meet unforseen events. In a constantly conflicting world situation with hot spots developing overnight, the industry's responsibility to itself as well as to the nation is deep and demanding.

As C. H. Lyons, president of Mid Continent Oil and Gas Association, brought out in his speeches to IPAA and API, there is a hard core of socialism in the Congress.

MR. LYONS: "Those who attack business and industry are succeeding to a far greater extent than is generally realized. Their attacks on the petroleum industry, for instance, are having a psychological effect on the minds of the American people, as witness the many sweeping attacks made on the industry today."

In other words, the socialists and left-liberals want control of the petroleum industry in Washington. One break in the long record of meeting the emergencies of war and lesser political crises would wipe out the independence the industry now holds.

A note of caution was sounded by Ohio Oil's president and The Texas Company chairman.

MR. LONG: "With the economic adjustments that are going on throughout the world, in our opinion a new appraisal of capital expenditures should be made by the oil industry. It is quite possible that the industry will not be able to sustain the rate of increase of capital investment that has occurred during the past several years.

"In making this statement, it is not intended to sound a pessimistic note as to the future, but we do believe that the industry has got to be more selective in its investments and that the pace of capital spending must be reduced."

MR. DONNELL: "It is quite evident that the record high capital expenditures of the past few years have resulted in plant capacity which exceeds current demands in many sectors of the economy. Recent surveys point to a reduction in outlays for new plant and equipment, a development which is expected to lead to some sort of adjustment in business activity. While capital expenditures in the petroleum industry will probably not be reduced, we must recognize that we have excess capacity in all phases of our industry, and we may have to adjust to still lower operating ratios. Such adjustments may be expected of the dynamic units which make up the petroleum industry, unless their flexibility is impaired by undue governmental interference."

Expenditures for plants and equipment and for finding and developing reserves look to us about like this in 1958:

Drilling and Producing	$5,000 million
Manufacturing	1,500 million
Transportation	650 million
Marketing	700 million
Miscellaneous	150 million
	$8,000 million

Of these expenditures about $1,500 million will be spent in foreign operations by U. S. companies and $6,500 million in domestic operations.

EMPHASIS ON RESEARCH is one of the best hopes of the future. For those companies that maintain their own research departments, there is an upward curve for expenditures both for operating and capitalization. This in itself does not mean success but it indicates the interest and faith of management in the ability of researchers to produce.

Research has created the great petrochemical in-

(CONTINUED ON PAGE A-38)

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Management in Current Business and the Ten Years Ahead

Russell H. Hassler

CURRENT FORCES which have an impact on management thinking include:

1. Increased pressure of technological change, such as growth in the fields of electronics, atomic power and automation in plant and office.

2. Ever-increasing push of our economy toward increased consumption in our service industries.

3. World climate in terms of national defense.

While many of us may not like it, we are facing the issue of survival. In the immediate years ahead, this may condition our entire management structure to a fight for survival carrying with it the implications of a managed economy.

As to the manager of the future, there are two interesting and dissimilar points of view. The first is that the manager of the future must be more of a generalist. He must understand more of how our mind works, of how we act in groups. He must know more of the functioning of our economic system; of the role our governments and business play in international affairs; of the growing acceptance of business responsibility and every phase of our community life.

Wholly dissimilar is the concept that the manager of the future will be practicing more of a science than an art. Hence we find schools of business talking more and more about increased attention to the application of higher mathematics to solving management's problems. While the two trends are not in direct conflict, they point up the tremendous range and power we expect from the manager of the future.

I fear we may be in danger of minimizing personal qualities of leadership if we place undue reliance on either mathematical answers to all our major business problems or on the role of the manager as being primarily one of crystalizing and summarizing other people's points of view.

We in business schools have a responsibility to be sure that scientific advances are discussed, known about, but also put in perspective. We have a responsibility to see that considerations of courage and leadership, while not subject, perhaps, to being taught, are vital and necessary and should not be abrogated to the cause of the whole organization man.

As we move into the future, there is need for direction — for a guiding, motivational force, both in our corporate life and for the individual manager. At the Havard Business School, in our Advanced Management Training Program, one of the things that has been apparent in almost all our groups has been an expressed need for a developed, conscious set of goals.

The craftsman of long ago developed tremendous satisfactions from his job; in our modern assembly line operations, we have struggled with the problem of worker satisfaction. Those who manage in business have the same need for job satisfaction. Because of the more intangible qualities of their work, the more difficult is the task of defining their hopes and satisfactions for a fuller life.

Development of direction for ourselves and our companies is not easy. It can be done superficially, very quickly. I commend to you that a worthwhile job in this area is one of the challenges for tomorrow. ★ ★ ★

NOTE: Condensed version of an address by Russell H. Hassler, associate dean, Harvard University Graduate School of Business Administration. Presented at National Conference of Controllers Institute of America, November 1, 1957.

dustry, which has opened a new field for oil and gas products. It has improved methods in every operation from exploration to marketing. Larger funds give research opportunity to generate new ideas for broader service. This, of course, concerns relation of research to profit, but one interesting point was made concerning the relation of profit to research.

MR. HELMERICH: "We feel very strongly in Helmerich & Payne, Inc. that if prices were stronger in the contracting business the large contractor would spend a considerable amount of money on research and development. The fact that prices are so weak has prevented a more rapid technological break-through in drilling methods."

OUTLOOK FOR 1958 was viewed with hope and anticipation by management. There was no indication that industry leaders were growing static.

MR. DUNLOP: "The year ahead is one that warrants an unusual sense of alertness to changing economic conditions. Despite these uncertainties in the immediate future, and the concern that the economy may soften even more before it gets better, there are still many opportunities for new achievement.

"To meet the challenge of increasing demand, the industry is devoting renewed attention to improving efficiency in order to increase sales and to develop new markets in new fields. Sun Oil Company is also working toward this end.

"By mid-year we shall have completed our custom-blending program with the installation of our new multi-grade pumps throughout our 21-state marketing territory. This revolutionary technique of marketing motor fuels makes it possible for the motorist to select the specific octane quality, and at the most economical cost, to satisfy the exact requirements of their cars.

"Sun remains confident that as long as the petroleum industry retains freedom of action to develop additional ways of giving better service, it can rise to tomorrow's challenge and maintain the progressive performance which the American public has come to expect of it."

MR. TALIAFERRO: "Despite natural and man-made obstacles, the industry should enjoy a continued growth in the years ahead as a result of forthcoming patterns in the American economic and social scene.

"Population increase alone will play a vital role in the industry's growth since our markets will increase accordingly. Population-wise, our nation is adding nine cities the size of Tulsa each year.

"Also, the multi-billion dollar highway construction programs, the development of suburban areas with their shopping centers, and the staggering increase in the number of automobiles are other spurs to the industry. Moreover, oil companies are developing more uses for oil products in such areas as petrochemicals."

Sinclair's president warns it won't be easy.

MR. SPENCER: "The industry must face the grim fact that demand for its products during the period December 1957, to April 1, 1958, probably will be 350,000 barrels daily below the similar 1956-1957 period. Refinery crude runs should be held to an average of 7,850,000 bbl daily, or 3.5 percent below last year's level, and yields of burning oils should be maximized if proper balance between supply and demand is to be accomplished.

"With processing thus reduced it would likewise be necessary to hold the new supply of raw material resulting from domestic production and imports of crude oil to an average of 7,850,000 bbl daily."

MR. FOLLIS: "Outlook for world petroleum in 1958 appears to promise at least a partial resumption of the growth pattern that characterized the industry in recent years prior to 1957. Barring any unforeseen disruption of normal activities, it is anticipated that gains will be experienced on both the domestic and free foreign fronts."

MR. MOSHER: "Establishing or maintaining world markets for crude and products is one of the current challenges within our highly competitive petroleum industry, but the long-term prospects remain bright by impartial statistical predictions as well as by the progressive and optimistic convictions inherent in oil men generally."

MR. JENNINGS: "There seems little doubt the oil industry is temporarily overbuilt both as to producing and refining capacity. As a result competition is increasingly keen, with prices being shaved in a number of markets.

"It may be some consolation that, as the highly competitive nature of the industry becomes so obvious, the ground is cut from under the charge that the oil industry is a monopoly. While we can hardly expect a respite from the hackneyed charge in an election year, it should get less than the usual mileage in the existing circumstances."

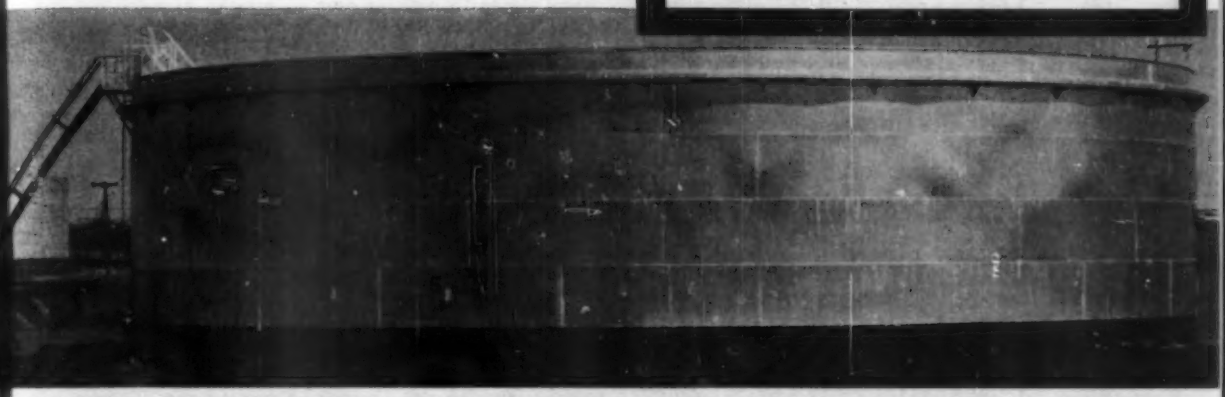
MR. McCOLLUM: "In retrospect, the most significant thing to me about the year 1957 was that all of these difficult problems were met and solved within the framework of our highly competitive, free enterprise system. Even the difficult problem of rapidly increased foreign imports was handled on a voluntary basis. Where necessary, the interests of individuals and of oil companies both large and small gave way to the interests of the industry and the nation as a whole.

"Notwithstanding these problems which will face us as the new year begins, I have great confidence in both the short- and long-term future of the U. S. petroleum industry. It met great challenges in 1957 and also put its house in order to meet the new challenges of 1958. The ingenuity and vigor of the oil industry's management has been strengthened and toughened by the difficult tasks of 1957. On the basis of past accomplishments, I am confident that this industry can marshall the managerial and technological skills necessary to meet the new problems of the future swiftly and effectively, provided that it continues to operate within the framework of our competitive free enterprise system." ★ ★ ★

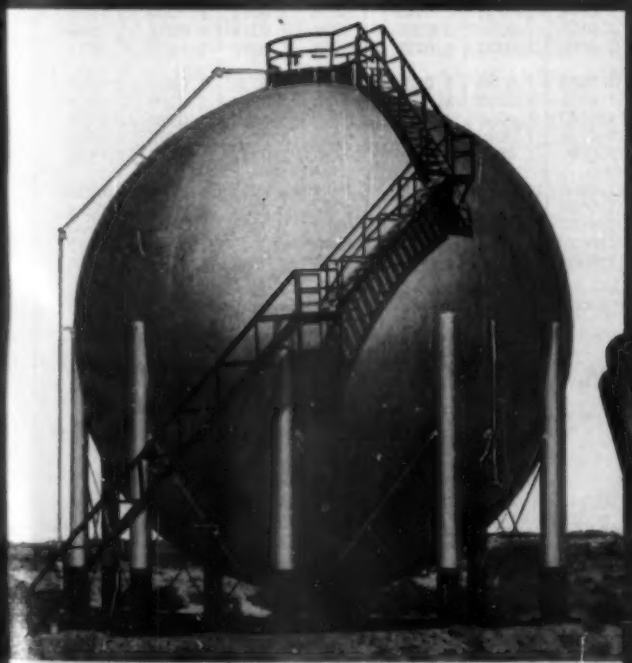
IN WYATT'S BOOK ON STORAGE

THE OLD and THE NEW add up to THE MODERN

NEW for PRODUCTS STORAGE: 30,000-barrel tank with Wyatt's Pontoon Type Floating Roof.



CONE ROOF to FLOATING ROOF: After repairs to bottom and shell and addition of a top ring with wind girder, this 55,000-barrel riveted tank was restored to sour crude service — its capacity increased to 58,600 barrels. Wyatt's Pontoon Type Floating Roof reduces Evaporation and Corrosion and prevents Fire.



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Avg. length of gas column, L, ft.	Specific gravity, G, = 0.60						Specific gravity, G, = 0.70					
	Temperature, °F.						Temperature, °F.					
	50	60	70	80	90	100	50	60	70	80	90	100
500	1.0111	1.0109	1.0107	1.0105	1.0103	1.0101	1.0129	1.0127	1.0125	1.0123	1.0120	1.0118
510	1.0113	1.0111	1.0109	1.0107	1.0105	1.0103	1.0132	1.0130	1.0127	1.0125	1.0123	1.0120
520	1.0116	1.0113	1.0111	1.0109	1.0107	1.0105	1.0135	1.0132	1.0130	1.0127	1.0125	1.0123
530	1.0118	1.0116	1.0113	1.0111	1.0109	1.0107	1.0138	1.0135	1.0132	1.0130	1.0127	1.0125
540	1.0120	1.0118	1.0116	1.0113	1.0111	1.0109	1.0140	1.0137	1.0135	1.0132	1.0130	1.0128
550	1.0122	1.0120	1.0118	1.0115	1.0113	1.0111	1.0143	1.0140	1.0137	1.0134	1.0132	1.0130
560	1.0124	1.0122	1.0120	1.0117	1.0115	1.0113	1.0145	1.0143	1.0140	1.0137	1.0135	1.0132
570	1.0127	1.0124	1.0122	1.0120	1.0117	1.0115	1.0148	1.0145	1.0142	1.0139	1.0137	1.0135
580	1.0129	1.0126	1.0124	1.0122	1.0120	1.0117	1.0150	1.0148	1.0145	1.0142	1.0139	1.0137
590	1.0131	1.0129	1.0126	1.0124	1.0121	1.0119	1.0153	1.0150	1.0147	1.0144	1.0142	1.0139
600	1.0133	1.0131	1.0128	1.0126	1.0124	1.0121	1.0156	1.0153	1.0150	1.0147	1.0144	1.0142
610	1.0136	1.0133	1.0130	1.0128	1.0126	1.0123	1.0158	1.0155	1.0152	1.0149	1.0147	1.0144
620	1.0138	1.0135	1.0132	1.0130	1.0128	1.0125	1.0161	1.0158	1.0155	1.0152	1.0149	1.0146
630	1.0140	1.0137	1.0135	1.0132	1.0130	1.0127	1.0164	1.0160	1.0157	1.0154	1.0152	1.0149
640	1.0142	1.0140	1.0137	1.0134	1.0132	1.0130	1.0166	1.0163	1.0160	1.0157	1.0154	1.0151
650	1.0144	1.0142	1.0139	1.0136	1.0134	1.0132	1.0169	1.0166	1.0163	1.0159	1.0156	1.0154
660	1.0147	1.0144	1.0141	1.0138	1.0136	1.0133	1.0171	1.0168	1.0165	1.0162	1.0159	1.0156
670	1.0149	1.0146	1.0143	1.0140	1.0138	1.0136	1.0174	1.0171	1.0168	1.0164	1.0161	1.0158
680	1.0151	1.0148	1.0145	1.0142	1.0140	1.0138	1.0177	1.0173	1.0170	1.0167	1.0164	1.0161
690	1.0154	1.0150	1.0148	1.0145	1.0142	1.0140	1.0179	1.0176	1.0173	1.0169	1.0166	1.0163
700	1.0156	1.0153	1.0150	1.0147	1.0144	1.0142	1.0182	1.0178	1.0175	1.0172	1.0169	1.0166
710	1.0158	1.0155	1.0152	1.0149	1.0146	1.0144	1.0185	1.0181	1.0178	1.0174	1.0171	1.0168
720	1.0160	1.0157	1.0154	1.0151	1.0148	1.0145	1.0188	1.0184	1.0180	1.0177	1.0174	1.0170
730	1.0163	1.0160	1.0157	1.0153	1.0150	1.0148	1.0190	1.0186	1.0183	1.0179	1.0176	1.0173
740	1.0165	1.0162	1.0159	1.0155	1.0153	1.0150	1.0193	1.0189	1.0185	1.0181	1.0178	1.0175
750	1.0167	1.0164	1.0161	1.0157	1.0155	1.0152	1.0195	1.0191	1.0188	1.0184	1.0180	1.0178
760	1.0169	1.0166	1.0163	1.0160	1.0157	1.0154	1.0198	1.0194	1.0190	1.0187	1.0183	1.0180
770	1.0171	1.0168	1.0165	1.0162	1.0159	1.0156	1.0200	1.0196	1.0193	1.0189	1.0186	1.0182
780	1.0174	1.0170	1.0167	1.0164	1.0161	1.0158	1.0203	1.0199	1.0195	1.0192	1.0188	1.0185
790	1.0176	1.0172	1.0169	1.0166	1.0163	1.0160	1.0206	1.0202	1.0198	1.0194	1.0190	1.0187
800	1.0178	1.0175	1.0171	1.0168	1.0165	1.0162	1.0208	1.0204	1.0200	1.0196	1.0193	1.0190
810	1.0180	1.0177	1.0174	1.0170	1.0167	1.0164	1.0211	1.0206	1.0203	1.0199	1.0195	1.0192
820	1.0183	1.0179	1.0176	1.0172	1.0169	1.0166	1.0213	1.0209	1.0205	1.0201	1.0198	1.0194
830	1.0185	1.0182	1.0178	1.0174	1.0171	1.0168	1.0216	1.0212	1.0208	1.0204	1.0200	1.0197
840	1.0188	1.0184	1.0180	1.0177	1.0174	1.0170	1.0219	1.0215	1.0210	1.0206	1.0203	1.0199
850	1.0190	1.0186	1.0182	1.0179	1.0176	1.0172	1.0221	1.0217	1.0213	1.0209	1.0205	1.0201
860	1.0192	1.0188	1.0184	1.0181	1.0177	1.0174	1.0224	1.0220	1.0215	1.0211	1.0208	1.0204
870	1.0194	1.0190	1.0187	1.0183	1.0180	1.0177	1.0227	1.0222	1.0218	1.0214	1.0210	1.0206
880	1.0196	1.0193	1.0189	1.0185	1.0182	1.0178	1.0229	1.0225	1.0220	1.0216	1.0212	1.0208
890	1.0198	1.0195	1.0191	1.0187	1.0184	1.0180	1.0232	1.0228	1.0223	1.0219	1.0215	1.0211
900	1.0201	1.0197	1.0193	1.0189	1.0186	1.0183	1.0235	1.0230	1.0225	1.0221	1.0217	1.0213
910	1.0203	1.0199	1.0195	1.0191	1.0188	1.0185	1.0237	1.0233	1.0228	1.0224	1.0220	1.0216
920	1.0205	1.0201	1.0197	1.0194	1.0190	1.0187	1.0240	1.0235	1.0231	1.0226	1.0222	1.0218
930	1.0208	1.0204	1.0200	1.0196	1.0192	1.0189	1.0242	1.0238	1.0233	1.0229	1.0225	1.0220
940	1.0210	1.0206	1.0202	1.0198	1.0194	1.0191	1.0245	1.0240	1.0235	1.0231	1.0227	1.0223
950	1.0212	1.0208	1.0204	1.0200	1.0196	1.0193	1.0248	1.0243	1.0238	1.0233	1.0229	1.0225
960	1.0214	1.0210	1.0206	1.0202	1.0198	1.0195	1.0250	1.0246	1.0241	1.0236	1.0232	1.0228
970	1.0216	1.0212	1.0208	1.0204	1.0200	1.0197	1.0253	1.0248	1.0243	1.0238	1.0234	1.0230
980	1.0219	1.0215	1.0210	1.0206	1.0203	1.0199	1.0256	1.0251	1.0246	1.0241	1.0237	1.0232
990	1.0221	1.0217	1.0212	1.0208	1.0205	1.0201	1.0258	1.0253	1.0248	1.0243	1.0239	1.0235

In sonic measurements of fluid levels to determine subsurface working pressures, it is necessary to include the pressure exerted by the weight of the gas column.

To use multipliers, select correct figure (based on the correct values of L, G, and temperature) and multiply the absolute pressure on the casinghead by selected figure to obtain absolute pressure at the base of the static gas column, i.e., the oil-gas contact.

Example: Casing pressure on a pumping well is 286.6 lb. per sq. in. abs. Gravity and temperature of the gas are 0.70 and 70°F., respectively. Depth to fluid level is 970 ft. What is pressure at fluid level in well?

Solution: From table, multiplier is 1.0243

286.6 × 1.0243 = 293.6 lb. per sq. in. abs. = pressure at fluid level.

In other words, weight of gas column is 7.0 lb. per sq. in.

Note: Multipliers are calculated from following formula[1]:

multiplier = (GL ÷ 53.34T) log e

where G = specific gravity of gas (air = 1.00)

53.34 = constant for air

L = length of gas column, ft.

T = absolute temperature of gas, °F.

log e = log to base 10 of Naperian log base = 0.4342945

[1]See page 162 of Monograph 7, U. S. Bureau of Mines.

Table suggested by W. F. Elting, Jr., Carter Oil Company, St. Elmo, Illinois.

Here's your Education . . .

An ideal curriculum is 190 course hours with heavy math . . . This is the first of two articles . . . the second one covers Petroleum Engineering Education Abroad

SO YOU WANT TO BE A Petroleum Engineer?

Harry H. Power

THE FIRST CURRICULUM in petroleum engineering was established at University of Pittsburgh in 1912.[1] Since that time, at least 25 institutions in the United States have organized separate departments in this branch of engineering. Options in some other branches of engineering, such as mining, exist at a few institutions. Undergraduate students increased from 2,534 in 1951 to 4030 in 1955. But graduate students remained constant at 165, comparing the two years.[2]

Many changes in the profession have occurred during the past 45 years. In early history of the industry, the geologist, mining engineer, and other experienced oil men contributed a vast amount of understanding and job-experience to the problems which confronted the petroleum engineering profession later.

In the beginning, the petroleum engineer's field involved sub-surface problems — planning and drilling of wells and design of casing programs. His recommendations for development were pointed to proper water shut-off and reduction of underground losses of all kinds. This led to more efficient methods in the recovery of oil and gas, and bases for prediction of future producible hydrocarbons and unmined reserves.

As the profession developed the petroleum engineer applied his knowledge of hydrocarbon chemistry, phase relationships and hydrodynamics to the flow of fluids, both underground and through vertical and horizontal conduits, to separators, treating systems and storage. Although he made small claims to mechanical design, his grasp of science and general engineering principles permitted him to select drilling and production equipment intelligently, and to operate it efficiently and economically. Like the mining engineer, the profession had so many duties of so many kinds that defining a petroleum engineer was difficult.

The Engineering Council for Professional Development has provided increased impetus to fundamental approaches to underground curricula. The proportion of semester hours spent on petroleum engineering seldom exceeds 20 percent of the total hours required for graduation. In recent years the fundamental problem method has developed rapidly in teaching even this small proportion of specialized subjects.[3]

In common with other engineering branches petroleum engineering literature has become increasingly mathematical. This situation presents the opposite viewpoint to the former "descriptive approach" and requires a study of the technical quality and quantity of undergraduate course requirements.

Although some mathematics beyond the usual calculus is recognized, the program should be so designed as to produce engineers at various terminal points, such as the four-year, five-year, or seven-year programs. The question of technical difficulties will be solved by the simple expedient of continuing studies into the graduate schools.

Two or three years of graduate study, or its equivalent, is a minimum additional preparation for a career in research or teaching.[3]

The "quantitative" or problem approach to specialized courses in petroleum engineering is not new. Although no yardsticks are recommended for such instruction, approximate standards may be justified, but differences in regional requirements will prevent adoption of rigid programs. A free exchange of ideas through educational societies, summer schools and industry channels should work to upgrade petroleum engineering curricula.

If, as Hollister [4] has said, the characterizing features of engineering are to include not only the ability to design in the liberal sense, but also to construct, operate and forecast, a specific application may be made to petroleum engineering.[4] Planning an oil field, spacing wells, selecting proper hole size and casing programs, and selection, placement and operation of producing equipment to meet definite objectives, require design consciousness. This is a different order from the concept of design as practiced ordinarily by the mechanical engineer. These functions are as inherently characteristic of petroleum engineering as the planning and sinking of a mine shaft are to the mining engineer.

The elements of design characteristic of the field may be traced through a broad outline of the work that the professional engineer is called upon to perform: [5]

I. DEVELOPMENT
1. well spacing;
2. well drilling;
   (a) order of exploitation of individual reservoirs.
   (b) hole size and hole size reduction with depth,
   (c) casing seats and casing problems,

Mr. Power is Professor of Petroleum Engineering, The University of Texas; was Fulbright Lecturer, Technological University, Delft, Netherlands, 1956.

(d) cementing programs,
(e) coring, sampling and logging programs,
(f) water, salt and other excluding programs,
(g) shooting, acidizing, fracturing and other programs for stimulation of production during well completion,
(h) programs for exclusion of sand, including use of screens, slotted liners and gravel packs,
(i) completion programs, including design of flow string and wellhead assemblies.

II. EXPLOITATION
1. selection and layout of surface plant;
(a) oil and gas separators, meters and testing facilities,
(b) tank batteries and manifolds,
(c) oil, gas and water lines,
(d) gas lift, pumping and other equipment for lifting reservoir fluids,
(e) pumping plants for surface transportation of fluids.
2. selection and layout of special plants;
(a) plants for pressure injection of fluids,
(b) plants for the preliminary refining of oil (oil treating plants; desalting, crude stabilizing, and de-hydrating plants).

Again, if the concept of "design" is to include the prediction of operating results from certain production practices, the characteristic features of the petroleum production engineering curriculum become increasingly apparent. This may be seen from the following classification, which shows the role of various basic sciences and engineering concepts in predicting operating results:

I. THERMODYNAMICS, to predict
1. pressure - volume - temperature - composition relationships of natural gas (including condensate gas), and oil and gas mixtures;
(a) in reservoir,
(b) in flow systems,
(c) in separators and storage tanks;
2. usual thermodynamic properties of reservoir fluids and products thereof, obtained through usual process of production practice; particularly to facilitate calculation of heat transfer from various flow and other systems to the surroundings and vice versa, and changes in heat contents during flow or processing.

II. FLUID MECHANICS (with thermodynamics), to predict
1. energy relationships, pressure gradients, friction and other losses, and production rates of single and multi-phase fluids in flow strings and in pipelines;
2. reservoir performance under various controls; estimating not only amount of original oil in place and future recoverable oil, but timing of its recovery. Essential features of modern reservoir engineering fall under this category.

III. GEOLOGY, CORRELATION METHODS, AND AUXILIARY TOOLS, to predict and/or determine
1. depth to key and pay horizons;
2. attitude, thickness and strike of producing horizons;
3. possible extension of reservoir;
4. spacing of wells;
5. homogeniety (or lack of homogeniety) of reservoir and persistence of productive and non-productive members;
6. possibilities of re-completions in the same reservoir, deeper reservoirs, or shallower reservoirs;
7. texture, porosity, permeability, and physical and chemical characteristics of reservoir rocks;
8. area, extent and spread of gas caps;
9. position and encroachment of bottom and edge waters.

IV. CHEMISTRY, to determine and/or predict
1. characteristics of rock surfaces, change of these characteristics with depletion, and effect of surface-active chemicals on recovery;
2. changes in rock permeability due to
(a) clay content,
(b) acidizing and other chemical treatment, and remedial measures;
3. results of oil treatment
(a) for removing objectionable constituents, such as sulfur and salt,
(b) for removing emulsions;
4. proper drilling fluid and results of the treatment of drilling fluids on completion and production;
5. proper oil well cement and results of cementing practice on completion and production;
6. role of various other plugging agents;
7. analysis of oilwell waters as an aid to correlation, plugging, injection and other problems;
8. cause and/or prevention of corrosion.

V. GENERAL, to determine and/or predict
1. effect of well penetration on rate and ultimate recoverable production;
2. effect of shooting and chemical treatment on rate and ultimate recoverable production;
3. effect of special methods for stimulation of production on rate and ultimate recoverable production, such as fracturing and other allied processes;
4. effect of "work-overs" and reconditioning on rate of production and ultimate recoverable production;
5. effect of fluid injection on rate of production and ultimate recoverable production;
6. effect of conservation measures on rate of production and ultimate recoverable production.

Economics

In common with all engineering branches, economics is an essential element and is basic to all problems of design, prediction and other characterizing features of the profession. The replies to a questionnaire prepared by the American Society for Engineering Education some years ago disclosed that economics and business administration were serious omissions from college engineering curricula.

Both general and cost accounting find their application to the petroleum engineer's work in the business of producing oil and gas. The many ramifications of these applications have been discussed previously.[6]

Characteristic Features of PE

From the above analysis, the need for revision of courses to reflect the characteristics of the profession is evident. Although opinion has not crystallized entirely, the literature reveals that the petroleum engineer has developed material that is distinct from other fields and characteristic of petroleum engineering alone.

For example, the flow of fluids through porous media in all its intricate ramifications *belongs* to petroleum engineering. Likewise, we can point to pressure-volume-temperature studies of hydrocarbons and their application to production problems. The flow of fluids in vertical pipes and the artificial lifting of these fluids involve problems in thermodynamics and fluid mechanics that have been developed by the petroleum engineer. Oil well pumping has presented problems involving energy losses and other basic engineering concepts. Flow of drilling fluids involves special problems not met ordinarily in fluid mechanics.[5]

Perhaps the most characteristic phase of the modern petroleum engineering curriculum is related to reservoir performance. Here, the use of the mathematical or quantitative approach has been developed highly in several areas (which have been described at length in the literature). Numerous examples imply that less stress should be laid on descriptive material and more on the theoretical scientific base.[3]

Ideal Curriculum

What would the "ideal" curriculum be? Perhaps 190 semester hours of course work, which would require at least 11 semesters for completion. In order to confine the work to a four-

year program, course deletions are obvious and will depend on whether the emphasis is to be on basic science and engineering, or on several phases of the field, such as production, development, reservoir mechanics, natural gas engineering, or geological engineering. Four-year programs for each of these subdivisions have been suggested previously.[7] Although the practicability of designing "specialities within a specialty" is questioned seriously, the inadequacies of the four-year program are manifest.

FIVE-YEAR PROGRAM.

Mathematics. Algebra (3); trigonometry (2); analytical geometry (2); differential calculus (3); integral calculus (3); advanced calculus (3)
Semester Hours 16

Physics. General (6); engineering (6)
Semester Hours 12

Chemistry. General (8); quantitative analysis (4); organic chemistry (4); physical chemistry (4); colloid chemistry (3)
Semester Hours 23

Drawing. Elementary engineering drawing (3); descriptive geometry (3)
Semester Hours 6

Geology. Physical geology (3); historical geology (3); mineralogy and crystallography (3); petrology (3); structural geology (3); stratigraphy (3); sedimentology (3); paleontology (3); petrography (3); geophysics (3)
Semester Hours 30

Mechanical Engineering. Mechanism (3); heat engines and laboratory (3); internal combustion engines (3); machine design (3)
Semester Hours 12

Civil Engineering. Surveying (3)
Semester Hours 3

Chemical Engineering. Fuels, combustion and heat balance (3); unit operations (3)
Semester Hours 6

Electrical Engineering. a-c and d-c machinery (3) and laboratory
Semester Hours 4

General Engineering. Engineering mechanics — statics, kinetic and kinematics (6); strength of materials (4); hydraulics (3)
Semester Hours 13

Petroleum Engineering. Introductory — problems (3); development and production methods (3); production laboratory (3); reservoir mechanics (6); natural gas engineering (3); design (3); logging methods (4); hydrocarbon thermodynamics (3); phase relationships (3); valuation and economics (3)
Semester Hours 34

English and Speech. Composition and rhetoric (6); technical report writing (3); literature, advanced grammar or public speaking (3)
Semester Hours 12

General. History (3); government (3); accounting for engineers (3); oil and gas law (3); hygiene and first aid (1); electives (humanities)
Semester Hours 19

Total hours required for five-year program 190

Graduate Programs

Need for graduate programs in petroleum engineering stems from several sources. A primary motive of compelling importance is the necessity of extending the usual four-year undergraduate curriculum to five years and thereby laying greater stress upon basic science and other subjects that were given insufficient emphasis in earlier years.

Several schools offer two bachelor degree programs, combining petroleum engineering with mechanical, chemical, or other branches which also have direct application in the oil producing industry. Other schools believe that graduate programs leading to the master of science, professional and doctor of philosophy degrees provide as good or better opportunity for versatility. This is particularly so where sufficient flexibility exists to strengthen the undergraduate program to suit individual requirements of the student.

A few educators in this field believe that only a small portion of the undergraduate curriculum should be devoted to specialization, reserving the graduate years for application and extension of prior studies in science and other supporting courses.

Production research in the graduate work of the petroleum engineering schools has varied from the more fundamental long-range projects to short-range "dollar-and-cents" programs. Many believe that the development of graduate students is of primary importance and that industry can be served best if broad training in the sciences is offered, reducing specialization to a minimum.

Several institutions outside of petroleum engineering have made the helpful suggestion that in lieu of research for the master's program the study of certain "tools of research" should insure the successful completion of the more advanced programs at the doctorate level.

While little difficulty is found in graduate teaching at the master's level, programs leading to the doctorate in petroleum engineering present problems which appear to be difficult, at least for those institutions not prepared to take the full responsibility implied in the catalog announcements.

In general, teaching staffs are too small and are too busily engaged in undergraduate teaching and routine to take the additional responsibility of graduate instruction and research leading to the doctorate. In those institutions which are financed principally by reason of undergraduate enrollments, graduate instruction has received only token residual attention.

Of interest as a possible remedy in this connection, are the so-called "centers of research" which have been described by James R. Killian Jr.[8], of the Massachusetts Institute of Technology. These inter-departmental organizations coordinate the activities of various departments in fields of mutual interest.

Although some institutions have attempted to meet this problem by setting up special institutes, and others have set up new departments, they have failed to recognize the importance of organizing the departments into a cooperative whole. Of most importance, though, is the full coordination of research with educational objectives. Of paramount importance in the development of graduate programs is the acquisition and training of staff for institutional research and teaching.

The petroleum engineer should have sound preparation in fundamental science and engineering.

He must develop a capacity to analyze his problems quantitatively and recognize the various elements involved.

He must know what qualities go to make up engineering judgment; that is, skill in reaching the best possible conclusions under the limitations of allotted time and required accuracy.

He must appreciate the importance of cost and of practical economics.

He must be able to organize his thoughts and to express them clearly through speech and in writing.

He must be willing and able to adjust his personality to his environment.

He must have a decided interest in continued professional development and a sound philosophy of social values.

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Photo paste-up is an artist's conception of Magnolia's electronic data processing section when a giant-sized IBM 705 is installed in the fall of 1959. The new computer, to be leased by Magnolia on a permanent basis, will be capable of making 8400 additions or 1200 multiplications a second.

Magnolia Expands Data Processing Section

A $2.5 MILLION giant-sized computer is scheduled for delivery in the fall of 1959 to Magnolia Petroleum Company, Dallas, Texas. The equipment will be leased on a permanent basis.

This new equipment, an IBM 705 computer, will require the full time services of 20 to 40 trained specialists to keep it operating at peak efficiency. Members of the company's data processing section are already preparing accounting, technical, and research programs, management and statistical reports for the computer, which A. G. Lucky, representative for International Business Machines Corporation, states will be one of the largest 705's ever built by his company.

A pioneer in the electronic data processing field, Magnolia has four medium-sized computers already in operation: One at the Beaumont refinery doing technical calculations, two for accounting purposes in Dallas, and one for research work at Magnolia's field research laboratory near Dallas.

Socony Mobil Oil Company, Inc., of which Magnolia is an affiliate, plans to install a large-scale computer for research and technical work in its computing center in New York next April.

L. E. Frensley, comptroller for Magnolia, says, "the demand of business today for reports, statistical data, and fast, accurate calculations on a variety of accounting and technical problems makes the use of electronic computers a necessity, not a luxury."

When in full operation, the IBM 705 generates enough heat to keep over five average-sized homes cozy during the middle of winter. Because of this and of its delicate electronic make-up, the new computer will be housed in an area with special cooling and humidity control equipment.

Directly in charge of Magnolia's data processing section is A. C. Buchanan, a recognized expert in preparation and application of business problems to computers. * * *

Laugh with Barney

Advertisement in Pakistan paper:
"Personal: Bachelor with 40 acres of excellent land would like to make acquaintance of lady with tractor; matrimony in mind. Please send picture of tractor."

Atomic brassiere: One with a 50 percent fallout.

From P. Miller of Saskatoon, Sask., Canada, we received this explanation:

The sexual life of the Camel
Is stranger than anyone thinks.
For once in a moment of weakness
It attempted to make love to the Sphinx.
Now the Sphinx's posterior arrangement
Lies buried deep in the sands of the Nile,
Which accounts for the hump on the Camel,
And the Sphinx's inscrutable smile.

After inheriting his father's harem, the hesitant young shiek said, "It's not that I don't know what to do. I just don't know where to begin."

A little common sense would prevent most divorces — and most marriages, too.

The chorus girl swept into the dressing room with a mink coat draped casually over her arm.
"Dearie," asked one of the other girls, "how did you ever get such a gorgeous mink? Why, I've been struggling for years to get one."
"Honey," replied the other, "you mustn't struggle . . . ever."

It was on a deserted street. The holdup man pointed a gun at a well-dressed, good-looking girl and commanded: "Stick 'em up!"
"You're out of luck," said the girl, "I haven't got a dime."
"Don't give me that stuff", sneered the robber. "Anybody as well dressed and good-looking as you always has dough."
"I'm not kidding" she replied,
"I'll find out for myself," said the robber, and he started searching her. He felt in her shoes, her hose, looked in her purse, in her pockets, felt in her bosom and finally in desperation, he searched her undergarments. He found no money. Stepping back, he disgustingly said, "okay, gal — go on. I've never seen anyone as broke as you.'
"That's what I tried to tell you, but I'll tell you what — if you'll frisk me again I'll write you a check."

Sign in cafe: Wanted — Man to Wash Dishes and Two Waitresses.

We have been receiving some wonderful stories from readers. Thanks for taking the time to jot them down and send them to us. This excerpt from a letter we received recently warmed our heart — and shook-up a "real" editor or two.
"P.S. The boss thinks I'm the intellectual type because I read in P.E. Little does he know I only read 'Laugh with Barney'."
Don't worry kind sir, your secret is safe with us. We do, however, have a few "other" features each month that are equally good. Hope you find time to read them.—Barney.

Management Personals

Charles E. Spahr was elected president of The Standard Oil Company (Ohio) succeeding **Clyde T. Foster,** who continues as chairman of the board and chief executive officer. Spahr has been executive vice president and Foster chairman and president.

John W. Gendron was named administrative assistant to the president, Tidewater Oil Company. He was formerly manager of oil purchase and exchange department. He is a director and vice president of Tide Water-Iran, Ltd., and a director and vice president of Iricon Agency, Ltd., of which he was president in 1956-57. He attended the American University and the University of Oregon, receiving a bachelor's degree from the latter. He also studied law at Georgetown University and the University of San Francisco, and attended Stanford University under the company's management development program.

Secretary of the Interior **Fred A. Seaton** announced the appointment of **Charles A. Nichols Jr.,** as foreign petroleum coordinator in the Office of Oil and Gas. He will assist **H. A. Stewart,** director of the Office of Oil and Gas, in coordinating activities with respect to foreign petroleum operations, represent the U. S. Government at petroleum meetings abroad, and take an active part in the operation of the Foreign Petroleum Supply Committee and its subcommittees under the Voluntary Agreement Relating to Foreign Petroleum Supply. Stewart retired in 1956 following 30 years of foreign service with the Standard Vacuum Oil Company.

Nikita Harwich was elected to the board of San Jacinto Petroleum Corporation and to the board of directors and executive committee of San Jacinto Venezolano, C. A., the subsidiary operating in Venezuela, it was announced by Benno C. Schmidt, board chairman of both companies. Harwich is a citizen of Venezuela, is president of Servicios Hydrocarb, C. A., and is active in other Venezuelan business enterprises.

The Fifth World Petroleum Congress, Inc., which was setup to organize the first international oil congress ever to be held in the United States, is being widely supported by the petroleum industry. Its members are: **Reid Brazell,** president and general manager of Leonard Refineries, Alma, Michigan; **F. S. Clulow,** recently retired vice president of Shell Oil; **Ira H. Cram,** a director and senior vice president of Continental Oil; **G. A. Davidson,** vice president and director of Standard of California; **C. Eugene Davis,** general secretary of the Congress, formerly vice president of Shell Oil; **H. W. Field,** vice president and general manager, research and development department, Atlantic; **W. C. Kinsolving,** president of Sun Pipe Line and Sun-Canadian Pipe Line; **Dr. W. E. Kuhn,** general manager, research and technical department, Texaco; **John W. Mecom,** Houston; **Dr. Jerry McAfee,** vice president of Gulf Oil; **E. B. McConnell,** director and vice president of Standard (Ohio); **E. V. Murphree,** president of Esso Research and president of the Congress; **H. B. Nichols,** senior vice president of California Texas Oil; **Carl E. Reistle Jr.,** director and executive vice president of Humble Oil; **J. K. Roberts,** director and vice president, Standard (Indiana), and **Dr. J. C. Zimmer,** technical advisor, research department, Socony Mobil.

Papers to be presented at the Congress have been divided into nine sections and a program coordination committee consisting of nine directors has been appointed to select papers for presentation. Each of the directors has been assigned a section for which they are responsible: Cram, geology and geophysics; Reistle, drilling and production; Field, oil processes and refining; McAfee, chemicals from petroleum and natural gas; Dr. Kuhn, composition, analysis and testing; Dr. Zimmer, utilization of oil products; Nichols, engineering, equipment and materials; Kinsolving, transportation and distribution, and Roberts, operations research, statistics and education.

P. A. Chester, Winnipeg, Canada, and **A. W. Tarkington,** Houston, were elected to the board of directors of Continental Oil Company. Chester is managing director of Hudson's Bay Company, Winnipeg, and Tarkington is senior vice president of Continental Oil. Chester is also a director of the Great-West Life Assurance Company Ltd., a governor of the Actic Institute of North America, and an associate of the Institute of Chartered Accountants, England and Wales. Tarkington attended Rice Institute for one year and received his bachelor's degree in business administration in 1932 from Southern Methodist University. He also is a director of the Independent Petroleum Association of America and Mid-Continent Oil and Gas Association, and a member of the American Petroleum Institute and the executive committee of Junior Achievement of Houston.

Patrick J. Keating Jr., was promoted to director of research at the Texaco Research Center, Beacon, New York. He was formerly assistant director. He is a native of Houston and received his BS in chemical engineering from Rice Institute in 1931. **John K. McKinley** was named to succeed Keating. He formerly was assistant to management in The Texas Company's research and technical department, which has its headquarters at Beacon. He received his BS in chemical engineering in 1940 and his MS in chemistry in 1941 from the University of Alabama.

Dr. Robert E. Conary has been named to a new assistant manager post in the research division of the research and technical department of Texaco. He was formerly director of research at the Texaco Research Center. Dr. Conary received his BChE degree from the University of Minnesota in 1934 and was awarded his PhD degree at the University of Wisconsin in 1938.

The new directors of Shelton-Warren Oil Company are: **C. D. Munger,** merchant and real estate operator, and **R. S. (Cinco) Rogers,** cashier of the Lea County State Bank. Rogers is a graduate of Southern Methodist University in Dallas where he majored in banking and finance and was awarded a BBA degree in 1950. Munger previously was central division sales manager of the M. K. Geotz Brewing Company of St. Joseph, Missouri.

B. E. Taylor, comptroller and director, was elected vice president and treasurer, and **Joseph Spivak** was promoted to exploration manager and elected a director of Mobil Oil of Canada, Ltd.

Howard W. Blauvelt, Ponca City, was elected senior vice president of Hudson's Bay Oil and Gas Company, Ltd., an affiliate of Continental Oil Company. Formerly assistant controller of Conoco, he will make his new headquarters at Calgary. **J. B. Cecil,** Houston, Texas, assistant to the controller, was elected to succeed Blauvelt as assistant controller of Continental Oil, with headquarters at Ponca City.

Norman Hardy, executive vice president of the Arabian American Oil Company, was elected president. He succeeds **R. L. Keyes,** who retires. Hardy has also been made chief administrative officer and a director of the company. His headquarters will continue to be in Dhahran, Saudi Arabia. **F. A. Davies** continues as as chairman of the board and chief executive officer.

T. C. Barger, Arabian American's representative to the Saudi Arab Government, was named a vice president and assistant to the president, and will continue to be headquartered in Dhahran. He is a graduate of the University of North Dakota.

T. M. Vail was elected secretary of General Petroleum Corporation, succeeding **James A. Grace,** who has retired after 21 years of service. Vail, attorney and assistant secretary prior to his promotion, has been with General Petroleum for 28 years. He received his LLB from the University of Southern California Law School.

DEATHS

Henry C. Cortes, 65, vice president and director of Magnolia Petroleum Company, died of a heart attack December 6, while in Honolulu, Hawaii. He was enroute to Taipei, Formosa.

E. C. Rechtin, 62, general manager of the Bethlehem Steel Company shipyards of Beaumont, died in Los Angeles. He designed and built two offshore drilling rigs — Mr. Gus 1 and the Mr. Gus 11.

George L. Gilbert, head of The Gilbert Company of Jackson and a pioneer landman and operator in Mississippi, died while on a trip to Ripley, Mississippi, during the second week of November.

Morris A. Simmons, 54, drilling equipment specialist for Continental-Emsco Company, died recently of a heart attack at his home in Dallas, Texas. A well-known veteran of the drilling equipment industry, Simmons joined Continental-Emsco in 1936.

Frank E. Richardson, of Shreveport, one of the world's foremost pipeline and oil refinery consulting engineers, died December 3 at a local hospital following a lengthy illness. At the time of his death Richardson was associated with Brown & Root, Inc.

Russell H. Gwinner, vice president in the oil loan department of Tulsa's First National Bank and Trust Company, died November 18 at the age of 62.

O. W. "Slim" Sisson, 69, died November 12 in Oklahoma City after a brief illness of two weeks. During the last 7 years, Sisson had been the store manager for Larkin Packer Company, Inc.

William Rowell Putnam, a well known figure in the utility industry, and a retired director and general consultant of Ebasco Services Incorporated, died November 12 at his home in New York, following a long illness. He was 81 years of age.

Fred Seaton Appoints 1958 National Petroleum Council

Interior Secretary names industry leaders to work with government on information research . . . Data provide basis for United States security and defense plans

Interior Secretary Fred A. Seaton has announced appointments to the National Petroleum Council for 1958.

The Council of oil and gas industry leaders was set up 11 years ago to provide advice and petroleum and gas industry information to the Government.

H. A. Stewart, director of the Department's Office of Oil and Gas, maintains close association with the Council on behalf of Government. During the year, he received several reports giving the latest information on industry's experience with underground storage of petroleum products and outlook for increased use of such storage, and the nation's surface storage capacity for both crude oil and petroleum products.

Data on the United States productive capacity for crude oil, natural gas liquids, and liquefied petroleum gases were also supplied.

The Council is studying current information on the nation's petroleum transportation facilities, which includes every mode of transportation for crude oil and products, and refinery capacity. It is expected that these reports will be supplied early next year to the Government.

When all the information comes in, Government will have an industry-wide inventory of the capabilities of the industry to produce, refine, store, and transport crude oil and petroleum products. These data provide the foundation for Government's security and defense planning.

Membership of the 1958 Council follows:

Robert O. Anderson, president, Malco Refineries, Roswell, New Mexico;

Earl Baldridge, president, Champlin Oil and Refining, Fort Worth; Munger T. Ball, president, Sabine Transportation, Port Arthur, Texas; A. F. Barrett, president, Rocky Mountain Oil and Gas Association (Mobil Producing, Billings, Montana); Paul G. Benedum, president, Hiawatha Oil and Gas, Pittsburgh; Fred E. Bergfors, Sr., president, Quincy Oil, Quincy, Massachusetts; Jacob Blaustein, president, American Trading and Production, Baltimore; Reid Brazell, president, Leonard Refineries, Alma, Michigan; J. S. Bridwell, Wichita Falls, Texas; Bruce K. Brown, president, Petroleum Chemicals, New Orleans; Russell B. Brown, Independent Petroleum Association of America, Washington, D. C.; H. S. M. Burns, president, Shell Oil, New York;

Orville S. Carpenter, president, Texas Eastern Transmission, Shreveport; James Comerford, president, Consolidated Natural Gas Company, New York; Howard A. Cowden, president, Consumers Cooperative Association, Kansas City; Robert L. Crawford, president, Independent Oil Men's Association of New England, Fall River, Massachusetts; John F. Cummins, president, Cumberland Oil Company, Nashville, Tennessee;

Morgan J. Davis, president, Humble Oil & Refining, Houston; J. S. Donnell, II, president, Ohio Oil, Findlay; Fayette B. Dow, National Petroleum Association, 958 Munsey Building, Washington, D. C.; Warwick M. Downing, Denver, Colorado; Gordon Duke, Southeastern Oil & Affiliates, Washington, D. C.; James P. Dunningan, The Lazy Oil Company, West Branch, Michigan; Paul Endacott, president, Phillips Petroleum, Bartlesville, Oklahoma; Max M. Fisher, board chairman, Aurora Gasoline Company, Detroit, Michigan; R. G. Follis, board chairman, Standard of California, San Francisco; Clyde T. Foster, president, Standard (Ohio), Cleveland; Stark Fox, executive vice president, Oil Producers Agency of California, Los Angeles; George T. Goggin, president; Independent Refiners of California (Douglas Oil of California, Paramount); B. C. Graves, board chairman, Union Tank Car, Chicago; B. I. Graves, B. I. Graves Associates, San Francisco; Frank L. Grimm, president, National Tank Truck Carriers, Washington, D. C.; Walter S. Hallanan, president, Plymouth Oil, Pittsburgh; Jake L. Hamon, Dallas; B. A. Hardey, Shreveport; John Harper, president, Harper Oil Company, Long Island City; I. W. Hartman, Mt. Pleasant, Michigan; Cash B. Hawley, president, National Congress of Petroleum Retailers, Detroit; J. J. Hedrick, president, Independent Natural Gas Association of America, Chicago; Harry B. Hilts, New York; D. A. Hulcy, Lone Star Gas, Dallas; G. B. Hunter, president, National Petroleum Association (Quaker State Oil Refining, Oil City, Pennsylvania);

A. Jacobsen, board chairman, Amerada Petroleum, New York; B. Brewster Jennings, board chairman, Socony Mobil, New York; Charles S. Jones, president, Richfield Oil, Los Angeles; J. Paul Jones, president, Pennsylvania Grade Crude Oil Association, Bradford; W. Alton Jones, board chairman, Cities Service, New York;

Paul Kayser, president, El Paso Natural Gas, El Paso, Texas; W. W. Keeler, chairman, Military Petroleum Advisory Board (Phillips Petroleum, Bartlesville, Oklahoma); Harry J. Kennedy, president, Western Petroleum Refiners Association (Continental Oil, Houston); Grover Kilgore, president, Petroleum Equipment Suppliers Association (Halliburton Oil Well Cementing, Duncan, Oklahoma);

Richard Gray, Lawton, managing partner, Lawton-Partee Oil, Magnolia, Arkansas; Augustus C. Long, board chairman, The Texas Company, New York; D. K. Ludwig, president, National Bulk Carriers, Inc., New York; Charlton H. Lyons, Sr., president, Mid-Continent Oil & Gas Association, Shreveport;

H. M. McClure, Jr., president, National Stripper Well Association, Alma, Michigan; L. F. McCollum, president, Continental Oil, Houston; Russell S. McFarland, president, Seaboard, Dallas; N. C. McGowen, board chairman and president, United Gas, Shreveport;

William G. Maguire, board chairman, Panhandle Eastern Pipe Line, New York; B. L. Majewski, president, Great American Oil Company, Chicago; J. Howard Marshall, Signal Oil and Gas, Fort Worth; A. C. Mattei, president, Honolulu Oil, San Francisco; R. L. Milligan, president, Pure Oil, Chicago; Miles Mills, Sr., president, National Oil Jobbers Council, Des Moines; William A. Moncrief, Fort Worth; S. B. Mosher, president and general manager, Signal Oil and Gas, Los Angeles; Glenn E. Nielson, presi-

dent, Husky Oil, Cody, Wyoming; S. F. Niness, president, Leaman Transportation, Downingtown, Pennsylvania; Maston Nixon, president, Southern Minerals, Corpus Christi, Texas; Joseph L. Nolan, manager, oil department, Farmers Union Central Exchange, St. Paul;

Jerome J. O'Brien, president, Texas Independent Producers and Royalty Owners Association (Monterey Oil, San Antonio); John F. O'Shaughnessy, vice president, Globe Oil and Refining, Wichita, Kansas; R. W. Otto, president, American Gas Association (Laclede Gas Company, St. Louis);

J. R. Parten, president, Woodley Petroleum, Houston; Joseph E. Pogue, petroleum consultant, Chase Manhattan Bank; Frank M. Porter, president, American Petroleum Institute, New York; David Proctor, executive vice president, Gulf Oil, Pittsburgh;

M. J. Rathbone, president, Standard (New Jersey), New York; C. Pratt Rather, president, Southern Natural Gas, Birmingham, Alabama; Sid W. Richardson, Fort Worth, Texas; A. S. Ritchie, Wichita, Kansas; M. H. Robineau, president, Frontier Refining, Denver; Roland V. Rodman, president, Anderson-Prichard, Oklahoma City; A. H. Rowan, Fort Worth;

Gordon Simpson, president, Independent Petroleum Association of American (General American, Dallas); P. C. Spencer, president, Sinclair, New York; D. T. Staples, president, Tidewater, San Francisco; Henderson Supplee, Jr., president, Atlantic Refining, Philadelphia;

Reese H. Taylor, board chairman, Union Oil of California, Los Angeles; J. E. Teague, president, American Association of Oilwell Drilling Contractors (Columbia Drilling, Houston); George T. Tennison, president, Natural Gasoline Association of America, (Shell Oil, Houston);

W. W. Vandeveer, president, Vanson Production, Cleveland; Willis G. Violette, president, Standard Oil (Kentucky), Louisville; S. M. Vockel, president, Waverly Oil Works, Pittsburgh;

J. Ed Warren, vice president, First National City Bank of New York; William K. Warren, board chairman and chief executive officer, Warren Petroleum, Tulsa; Everett F. Wells, president, Ashland Oil and Refining, Ashland, Kentucky; W. C. Whaley, president, Sunray Mid-Continent, Tulsa; John H. White, president and board chairman, Port Oil Company, Charleston, South Carolina; Robert E. Wilson, board chairman, Standard Oil (Indiana), Chicago; Robert F. Windfohr, Nash, Windfohr and Brown, Fort Worth; John Wrather, board chairman, John Wrather, Inc., Fort Lauderdale, Florida; George S. Young, president, Columbia Gas System, New York. ★

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The Trade PARADE

Service Company Formed

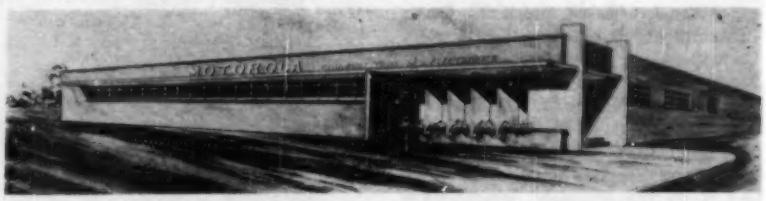
A new wireline service company, Welex, Inc., has been formed from the combined assets and personnel of the former Welex Jet Services, Inc., and the electrical well services department of Halliburton Oil Well Cementing. Officers of the Fort Worth, Texas, firm are: Ray O. Shaffer, president; J. B. Vaughan, vice president-sales; Tom E. Morton, vice president-operations T. W. Painter, vice president-manufacturing and administration, and H. T. Jarmon, secretary-treasurer. The new company was formed to provide better and more complete wireline services to oil operators and producers.

Halliburton Wins Award

The best 1956 annual report among oilwell supply companies was produced by Halliburton Oil Well Cementing Company, a national judging team has announced. Logan D. Campbell, Halliburton's chairman, and John P. Harbin, controller, were presented a bronze "Oscar of Industry" for the company's 1956 annual report at a banquet in New York City. Runner-up to the Halliburton annual report in the oilwell supply category was Dresser Industries, Inc. Third place was given the National Supply Co.

Waukesha Purchases Climax

The Waukesha Motor Company of Waukesha, Wisconsin, has announced purchase of the complete plant and assets of the Climax Engine Manufacturing Company of Clinton, Iowa, manufacturers of internal combustion engines. Addition of the Climax line of gas engines ranging up to 600 hp, will enable Waukesha to offer engines for services requiring power capacities intermediate between the ratings of many of its existing models. As a result, Waukesha will have complete coverage in a power range up to approximately 1200 hp.



New Dallas offices of Motorola Communications and Electronics, Inc., will house administrative headquarters for 10-state southern area as well as microwave and 2-way radio sales offices and an expanded parts depot.

Oscillograph Output Expanded

Heiland Division of Minneapolis-Honeywell Regulator Company, Denver, has added an additional 12,000 sq ft to its present plant area, a 25 percent increase to expand production of its line of oscillographic instruments. The addition of the new space is the second major physical expansion for the firm within two years.

A West Coast regional office has been opened in Los Angeles by Datamatic, another division of Minneapolis-Honeywell, for the manufacture of large-scale electronic data-processing systems. Samuel J. Weigand, recently named West Coast sales manager, will head the new office.

Scotland Plant Underway

Construction is underway on a $250,000 manufacturing plant at Glenrothes, Scotland, according to Dr. Arnold O. Beckman, president of Beckman Instruments, Inc. The new plant will house the company's newly-formed subsidiary, Beckman Instruments, Ltd. The Scottish plant is scheduled to begin operations in February with the manufacture of precision potentiometers, components for electronic instruments and systems. Currently these components are manufactured at Newport Beach, California.

Wyatt Expands Operations

Wyatt's Plastics, Inc., subsidiary of Wyatt Metal & Boiler Works, has expanded its manufacturing operations with a new plant at Wallis, Texas, 37 miles west of Houston. Although this plant will not be restricted to working with rubber, its major output will consist of the custom molding of rubber parts and the manufacture of rubber sheet stock, as well as a combination of rubber and plastics.

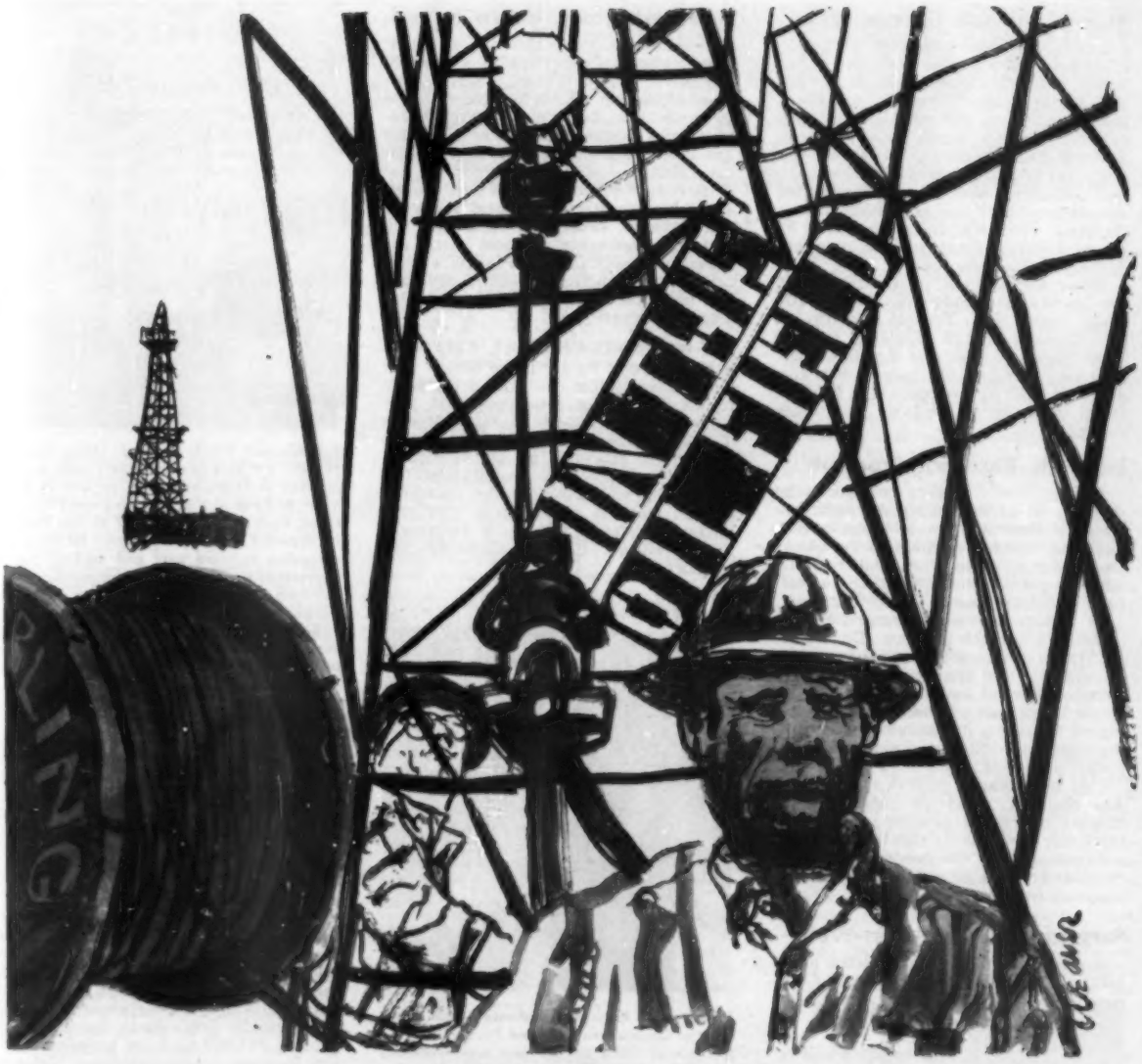
Wyatt de Mexico, S. A. de C. V. is the new name for Productos de Hierro y Acero, S. A., another subsidiary of Wyatt Metal & Boiler Works. The concern whose plant is at Tlalnepantla, Estado de Mexico, outside Mexico City, was purchased by Wyatt early last year. Officials of the concern, whose name was changed recently, are T. J. Uhl, Jr., president and general manager; Lic. Juan M. Steta, secretary and a director; Lic. Augustin Santamarina, director.

Drilco to Handle Reamer

Drilco Oil Tools, Inc., has purchased from Reed Roller Bit Company the Reed reamer in the Permian Basin area, including all bodies and cutters, it was recently announced. Drilco will sell and service the West Texas-New Mexico area with reamers for all hole sizes.

E. N. Gosselin, chairman of Graver Tank & Manufacturing Company, Inc., East Chicago, Indiana, left, presents a colonial bouquet to Mrs. Ted Mangelsdorf while Mangelsdorf, right, vice president of The Texas Company, looks on. Graver "bought out the house" of the famed musical, "My Fair Lady" during the American Petroleum Institute convention in Chicago to mark the end of Graver Tank's 100th birthday celebration.

Mr. and Mrs. A. Blumenfeld, Waring Carrington, sales manager of Danforth Anchors, and Ted Stephens, co-owner of Stephens Bros. at the launching of the Stephens cruiser, Marablu. Danforth Anchors half-millionth anchor went into use in 1947. First anchor of the second half-million, a 60-lb Hi-Tensile, was chrome plated and presented to Blumenfeld. The Danforth anchor is seen on the wall above Carrington's head.



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Trade Parade

Fluor Contracts German Firm

Fluor Products Company, Whittier, California, has signed an exclusive agreement with Maschinenfabrik Hartmann A. G., Offenbach, Germany, to design, manufacture, and sell the German firm's complete line of heavy duty industrial pneumatic and mechanical conveying systems, ash handling systems, dust removal, and classifying systems. In line with the agreement, Fluor has established a new division, Fluor-Hartmann, headed by James Elizardi, formerly vice president Mid-Continent sales area.

Fluor Corporation of Canada, Ltd., has moved its headquarters from 200 Bloor Street, East, Toronto, Ontario, to the Continental Life Building at 160 Bloor Street, East, in that city. In its new quarters the engineering-construction firm will have 4200 sq ft of space with an additional 2600 sq ft available for future expansion.

Expands Research Program

Hughes Tool Company announces the stepping up of its drilling research program in Houston, Texas. When a new steel and masonry addition to the block-long Hughes engineering and research laboratory is completed, working area will have been increased by about 50 percent.

In announcing the expansion of the company's research program, Dr. Daniel J. Martin, vice president-engineering, pointed out that the highly competitive nature of the oil industry and steady increase in the cost of finding and recovering oil is making it mandatory that drilling tools and drilling techniques be constantly improved.

"We are doing a great deal of day-to-day research," said Dr. Martin, "but Hughes' efforts are directed primarily to the future. I would say that today, we are anticipating what the needs of the drilling industry will be three, five, or even ten years from now."

Forsman to Head Win-Well

Robert A. Forsman was elected president of Win-Well Manufacturing Company, succeeding William B. Pollock, resigned. Win-Well headquarters will be moved from Los Angeles, California, to Tulsa, Oklahoma, in order to accommodate expanding sales and distribution of the company's multi-port rotary selector valve.

Forsman was formerly assistant chief engineer of the refining division of the Deep Rock Oil Corporation, and prior to that he was with Oklahoma Natural Gas Company. He is a graduate of the University of Tulsa.

A NEW ILLINOIS CORPORATION, Roper Hydraulics, Inc., has begun operation, taking over the pump business of Geo. D. Roper Corporation, Pump Division. This change is in keeping with a program which began in 1949, separating the pump operations from the household appliance activities of the corporation. Officers of Roper Hydraulics are John H. Makemson, president; Fred Dickerson, vice president, and Charles Oehler, secretary-treasurer. Other executives include J. M. Hoskinson, sales manager; John Albright, chief engineer, and Richard Corrigan, advertising manager.

Rockwell Holds Valve School

A course on valve care and maintenance completed at Phillips Petroleum Company, Borger, Texas, begins an intensified nationwide educational program in this field launched by Rockwell Manufacturing Company. More than 300 Phillips valve repair men, pipe fitters, engineers and operators were briefed by top Rockwell engineers and sales personnel. Ten 3-hour meetings were held in Borger and Guymon, Texas. The course and the 180-page instruction manual were designed especially for personnel of chemical plants, refineries, gasoline, and carbon black plants and production and engineering departments.

AN ORGANIZATIONAL CHANGE has been made by De Laval Steam Turbine Company that will place supervisory responsibilities for production and procurement under a single manager. Mervin T. Flock has been named manager of production and procurement, and Richard P. Springle was named purchasing agent. The new set-up will provide better coordination of material procurement with production scheduling, Charles A. Jurgensen, vice president of manufacturing announces.

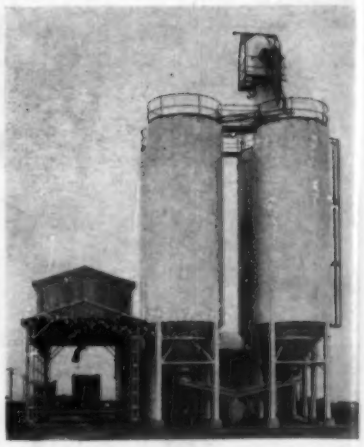
Photo shows George Christensen, vice president of Christensen Diamond Products, laying a brick of Christensen's new manufacturing plant in Celle, Germany. About 26 miles from Hannover, Germany, the plant will be the fourth foreign bit manufacturing plant established by Christensen since 1953. This new company is Christensen Diamond Products Company G.M.B.H.

Sales Agents Named

The Fibercast Corporation, manufacturers of glass reinforced epoxy resin line pipe and well tubing, has announced the appointment of R. W. Fowler and Associates as sales representatives for the Southeastern area with headquarters in Jacksonville Beach, Florida. A subsidiary of The Youngstown Sheet and Tube Company, Fibercast is located in Sand Springs, Oklahoma.

Planning Department Set Up

Organization of a development planning department with O. D. Myrick, Jr., as director, is announced by the Davison Chemical Company Division of W. R. Grace and Company. Purpose is to assist in expansion efforts of the company's product divisions; investigate areas in which the existing product structure might be extended and conduct special studies of a general management nature.



Bulk Cement Plants Erected. Three identical 14,000 cu ft bulk cement plants were erected recently in Texas, one at Alice, one at Beaumont, and one at Victoria, for Dowell Incorporated. Each unit is comprised of four 3600 cu ft capacity silos with hopper facilities for unloading railroad cars and loading trucks. Correlated bucket elevators for moving material from cars and to the blender on a production line basis are incorporated. These bulk cement plants were designed, fabricated, and erected by Rig Engineers and Fabricators Company, Inc., Houston, Texas.

UOC Opens Chicago Office

Universal Oil Products Company announced its Chicago, Illinois, office will be in Suite 2061 of the McCormick Building, 332 South Michigan Ave. The company, which has had its general headquarters in Des Plaines since 1952, maintained offices at 310 South Michigan for more than 30 years.

Addition Completed

National Aluminate Corporation recently completed an addition that more than doubles its administrative and laboratory facilities. Total office, laboratory, manufacturing and warehouse area for the chemical firm's main operation now exceeds 365,000 sq ft, on property covering 16 acres — and establishes Nalco as one of the largest companies in Chicago, Illinois, clearing industrial district.

TWO NEW LOGGING UNITS WERE opened recently at Woodward, Oklahoma, and Freer, Texas, by Schlumberger Well Surveying Corporation. Additions will facilitate service in the vicinity of these two towns. Schlumberger also announced that C. R. Perry has been named sales engineer at Gretna, Louisiana.

Shaffer Company Formed

Donald U. Shaffer, president of Shaffer Tool Works, announced formation of a new corporation to be known as Shaffer Western Hemisphere, Inc. The new corporation was organized to facilitate Shaffer operations in the various oil and gas countries of the Western Hemisphere. The first division of the new corporation will be a Canadian division.

PEOPLE

Wolverine Expands R&D

Calumet & Hecla, Inc.'s Wolverine Tube Division has established a separate new products division and an operations division. R. M. Frink has been named to the

R. M. Frink

E. C. Walter

newly created post of director, new products division and E. C. Walter was named director of operations. Previously, research and development was the responsibility of the former operations control division, directed by Frink.

Completion of the first of four major expansion projects undertaken by Wolverine was announced when divisional headquarters were moved to the newly constructed administrative center at Allen Park, Michigan, at 17,200 Southfield Road. Executive offices at the Detroit plant and sales department offices in downtown Detroit are now centralized.

Fred Royse

D. T. Bixby

The Fluor Corporation: Fred Royse, sales manager, Houston, since 1946, is promoted to the newly created post of vice president, sales. He is a Rice Institute graduate and has been associated with Texaco and Humble. Edward McNary has been appointed controller and assistant secretary succeeding John Schuler, named to newly created post of controller for Fluor of Canada.

De Laval Steam Turbine Company: Donald T. Bixby has been named assistant manager of the standard products division. He has been sales manager of the division since 1955.

W-K-M, division of ACF Industries: Victor Valaska was appointed foundry superintendent, and will be responsible for all production operations at the foundry. Glenlyn H. Blackburn is new foundry manager.

Byron Jackson Tools, Inc.: John O. Hankins has been moved to Venezuela and will assist in the promotion of sales and service of BJ oilfield products in Venezuela. He was formerly district manager of the Kansas-Oklahoma area.

Jones & Laughlin Supply Division: John L. Leimbrook, graduate of Texas A&M, is new salesman at Farmington, New Mexico, store, and Paul C. Smith, formerly salesman at Pawhuska, transferred to Woodward, Oklahoma.

F. J. Langtry W. D. Willes W. E. Bradbury A.W. Brandmaier H. B. Pillatt

Rockwell Manufacturing Company: Weldon D. Willes, assistant to the president, has been named general manager of the company's new plant at Kearney, Nebraska. Fred J. Langtry, assistant works manager of the Oakland, California, plant, has been promoted to works manager at Kearney.

Allis Chalmers Manufacturing Company: J. D. Harmison is appointed sales manager, material handling, Buda Division. He has been manager, parts sales, for the tractor group. Vice presidents are E. J. Mercer, general manager, construction machinery division; P. F. Bauer, managing director, Allis-Chalmers International, and William M. Wallace, general manager, general products division. A. D. Dennis, assistant secretary and assistant treasurer of the company, was elected secretary, succeeding W. E. Hawkinson, retired.

Beckman/Scientific Instruments Division: Elwood F. Blondfield was appointed product line manager, electro-chemical and gas analysis instrument groups. He was formerly product sales supervisor, gas analysis instruments. Charles D. Kennedy is new product specialist for Beckman pH-electrochemical instruments, and David C. Nelson, new product line specialist in the gas analysis group. Samuel H. Ashworth was appointed infrared product specialist.

McCullough Tool Company: William Newashe, Jr., branch manager, has been transferred from Kimball, Nebraska, service branch to the Rock Springs/Big Piney area in Wyoming. Headquarters will be at Big Piney service branch.

Consolidated Electrodynamics Corporation: Walden E. Bradbury is new manager of district sales office in Washington, D. C., succeeding Albert W. Brandmaier, named manager of European sales office; Robert H. Kitson, former San Diego office manager, new Beverly Hills Manager; S. R. Wyzenbeck, Jr., succeeds Kitson. Monte L. Marks is new chief development engineer, analytical and control instruments division. Donald H. Montgomery, with the company since 1951, was appointed senior supervisory development engineer. Three new divisional advertising managers are Paul N. Bertness, advertising and sales promotion of the systems and transducer divisions; S. Frank Buck, DataTape and central manufacturing, and Thomas H. O'Connor, Datalab, Alectra, Glendale, and analytical and control instruments divisions.

Bethlehem Steel Company: Harold B. Pillatt is new general manager of Gulf district. He has been assistant manager of the Beaumont Yard since 1955.

Barrett Division, Allied Chemical & Dye Corporation: P. B. Mayfield is manager of industrial tar products sales. A graduate of Texas A&M, he joined Barrett in 1949 as consultant.

Axelson Manufacturing Company: George W. Morte was named district manager, hydraulic sales and service. Area will cover Permian Basin and Louisiana. He was previously district sales manager. Jack L. Thompson has joined hydraulic sales department and will serve in the Permian Basin and Louisiana.

L. C. Waterman J. H. Burrell J. W. Hakeman T. R. Fullinwider Gerald Seber

Petrolite Corporation: Logan C. Waterman is new sales manager of Petreco division. A Rice graduate, he has been with Petreco since 1926. Ellis L. Ganey, Jr., former La Salle Pump and Supply employee, is named field engineer; James P. O'Connor, The Texas Company, is corrosion engineer, New Orleans, Louisiana. New assistant division managers: James W. Hakeman, former senior corrosion engineer, Rocky Mountain division, and James H. Burrell, Jr., former senior field testing engineer, West Central Division. Warren E. Moore has joined the company as corrosion engineer; Lloyd G. Heape, field engineer, assigned to special corrosion work; Dwain R. Brown has taken over Heape's field duties. John H. Spoede, Jr., has transferred from Rosenberg, Texas, to Venezuelan staff at Maracaibo; Bobby G. Little, field engineer at McCamey, Texas, transferred to Cortez, Colorado, as representative for the area.

Mission Manufacturing Company: T. R. Fullinwider, with the company 10 years, is new domestic sales manager. Gerald Seber is appointed export sales representative. He was formerly field sales representative.

Westinghouse Electric Corporation: John L. Cross is now industrial sales manager, Atlantic apparatus sales region in Philadelphia. Cross entered the Westinghouse student training course in 1933.

Trade Parade

Schlumberger Well Surveying Corporation: New sales engineers: R. L. Smith, Corpus Christi, Texas; C. R. Perry, Gretna, Louisiana; M. J. Broussard, Lafayette, and C. B. Dennis, Houma, Louisiana.

Crane Company: George F. Burley is now vice president for purchasing and traffic. He succeeds Lucien W. Moore, resigned. New vice presidents are: Maurice Nelles, vice president for engineering and Paul S. Kempf, vice president for personnel and industrial relations.

Win-Well Manufacturing Company: William B. Burkman is new sales representative for Houston area. He was sales and service engineer of the Gulf Coast district for Industrial Instrument Company before starting his own company.

C. C. Brush | M. W. Hartman | Mario Cueto | W. E. Dobbins | J. L. Patton

National Supply Company: Charles C. Brush has been appointed chief field engineer of Spang-Chalfant Division, succeeding Howard G. Texter, retired. Brush has been assistant chief field engineer since April 1957. Arthur W. McKinney, president, was elected to the board of directors of the Allegheny General Hospital, Pittsburgh.

Darling Valve and Manufacturing Company: M. W. Hartman has been named sales manager of the Darcova Division. This is a newly created post. He has been district sales engineer since 1946.

Reed Roller Bit: Mario Cueto, special sales representative in Buenos Aires, Argentina, has been appointed manager of export sales. Cueto joined Reed in 1940.

Dresser Industries, Inc.: William E. Dobbins was named as director of the Washington office. He has been central regional manager for Clark Bros. at Houston, Texas.

M. W. Kellogg Company: J. L. Patton, formerly section foreman, is new manager of the chemical process division. He has been with the company since 1944, and is a graduate of the University of Tennessee.

Houston Oil Field Material Company, Inc.: B. J. Breeden was named to service sales representative, Houston, Texas. H. D. Dawson transferred to directional drilling, Maracaibo, Venezuela; Wm. H. Dodson, Jr., transferred to sales, Kimball, Nebraska; Wm. B. Hackett named assistant manager of field maintenance, Houston, Texas; Jack B. Hallonquist, to assistant store manager, Liberty, Texas; Jimmy R. Keyes to fishing tool export, Maracaibo, Venezuela; A. R. King to store manager, Pearsall, Texas;

C. L. Littlepage was promoted to sales and service representative, Houston; C. L. (Hal) Ronch to executive vice president, Oil Equipment, Ltd., Canada; Jerry G. Romine, Lovington, New Mexico; Rayford L. Sewell to Brookhaven, Mississippi; Dillard L. Thomas to sales, Kenedy, Texas; C. J. Erwin to manager, export, New York City; H. D. Robinson to assistant export manager, New York City.

American Cyanamid Company: James F. Allen has been appointed manager of the refinery chemicals department, industrial chemicals division. J. G. Affleck has been appointed manager and R. W. McCullough, sales manager, for the rubber chemicals department of the organic chemicals division.

Manning, Maxwell & Moore, Inc.: Arthur W. Johnson has been named manager of Ashcroft gauge products, and Jack E. Cox, manager of Consolidated safety valves. Johnson joined the company in 1943. Cox, who succeeds Johnson, was recently sales engineer in the New York area.

Web Wilson Oil Tools: Oscar Bernardes of Equipan, Equipamentos Gerais, Ltda., of Rio de Janeiro, Brazil, and Klaus Wolf of Fagro GmbH fur Erdol und Bergbau, Hannover, Western Germany, have received factory training courses in the manufacture and operation of Web Wilson products in Los Angeles.

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OF PUMPING SERVICE

. . . no replacements other than spark plugs and magneto points on this **WISCONSIN Engine**

HERBERT FOWLER, pumper for the Ben Culver Oil Wells, operating in Osage County, Oklahoma, has been pumping Well No. 6 with a 2-cylinder Wisconsin Model TFPD Wisconsin Air-Cooled Oil Well Pumping Engine since its installation in Feb., 1954 . . . producing from the Mississippi Chat formation at about 2,000-ft. depth.

Fowler reports, in a sworn statement dated Sept. 4, 1956, that this engine was operated up to 10 hours per day, with an average of 6 hours per day pumping both oil and water. During the 2½-year period covered by this report, the engine had never been removed from its foundation. The cylinder heads had never been removed, valves had been adjusted only twice and the only service parts used were two sets of spark plugs and two sets of magneto points.

It is performance records such as this that offer convincing proof of Wisconsin Heavy-Duty Air-Cooled Engine stamina and low-cost maintenance. They're built to "take it" under *your* operating conditions . . . and there's an engine of the right size to fit your requirements . . . 4-cycle single cylinder, 2- and 4-cylinder models, from 3 to 56 hp., backed by a service organization second to none for swift attention to your needs.

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Caterpillar Tractor Company: John G. Montag is moving to Sao Paulo, Brazil, as assistant managing director and sales manager of Caterpillar Brasil S. A.; and Clifford A. Barabe, Jr., will remain in Peoria and succeed him as manager, sales departments.

Baroid Division National Lead Company: C. W. Felker, formerly superintendent of the Southwest Louisiana district, has transferred to New Orleans as assistant manager of Louisiana Baroid sales; F. D. Franklin, Jr., named sales representative with headquarters in New Orleans; Paul A. Newton is manager of the Louisiana district; R. T. Sutton, appointed superintendent of the Southwest Louisiana district at Lake Charles. Replacing him as superintendent of the North Louisiana and Arkansas district is Arlen E. Milligan. J. M. Humble has been appointed superintendent of South Central Louisiana at Lafayette. E. H. Hearn is sales representative at Shreveport, and S. E. Marrs, service engineer, has been appointed sales representative at Lafayette.

Joy Manufacturing Company: William L. Wearly has been elected president after the resignation of John Lawrence. A. B. Drastrup was elected executive vice president to fill the position formerly held by Wearly. Wearly has been with the company for 20 years.

Atlas Powder Company: Theodore P. Malinowski is now assistant director of product development, chemicals division. He was development manager in the department.

T. P. Malinowski

U. S. Steel Corporation: L. C. Simmons was promoted to assistant executive vice president, accounting, succeeded by Russell M. Braund as vice president, accounting; Robert L. Swank, Northwestern University graduate, appointed manager of sales-plastic pipe, National Tube Division, and Thomas D. Cramer, assistant manager of sales—plastic pipe, U. S. Steel Division. Oil Well Supply Division, new field representatives: Gene H. Stumpf, Fort Morgan, Colorado; George R. Day, Estevan, Sask., Canadian area; Joseph L. Cashion, Corpus Christi, Texas. New store manager: Clifford W. Snell, Blanding, Utah. Store managers transferred: Angus F. Blunderfield, to Drayton Valley, Alberta, Canada, from Okotoks; William A. Slocombe from Red Deer, Alberta, to Calgary. J. C. Whetzel is new manager of tin plate products for United States Steel, succeeding George E. Totten, retired. Ray D. Morrison, former field representative, is appointed district representative, Charleston, West Virginia.

Broderick & Bascom Rope Company: J. J. Sieber named vice president in charge of sales. K. B. Britt will succeed Sieber as sales manager.

Cardwell Manufacturing Company: Willis L. Chase is district sales representative for the Rocky Mountain area. He recently was sales representative for Meredith GMC trucks in Casper, Wyoming. Bob Smock is new credit manager. He moves up from assistant credit manager.

W. C. Norris Manufacturer, division of Dover Corporation, Tulsa, Oklahoma, has created two new sales divisions. J. A. Getty, former district representative at Shreveport, Louisiana, has been transferred to Tulsa to head the new central division. Under his supervision, as division manager, are the Kilgore, Texas, Oklahoma City, Oklahoma, Great Bend, Kansas, branches, and the Tulsa sales staff. W. J. Whitaker has been made division manager for the North and West Texas areas, with division office in Fort Worth, Texas. The Gulf Coast division continues to operate under the direction of C. L. "Les" Snelling, division manager, Houston.

Snelling Getty Whitaker

Attends Executive Course

Miss Jo Ann Wilbanks, assistant export manager, and Miss Barbara Hinson, executive secretary for Weatherford Oil Tool, attended the first session of the American Management Association's Executive Action Course held in New York City recently. This is in line with the company's policy to encourage the free flow of creative ideas and develop improved management communications.

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FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

Trade Parade

International Harvester Company: W. C. Schumacher, former vice president, is new executive vice president and member of the board of directors. Schumacher was general manager of the motor truck division in 1946, and guided it through its period of greatest growth and development. In May 1953, he was elected a vice president of the company and continued as executive head of the motor truck division.

Chicago Bridge and Iron: Arthur R. Simpson, member of the general sales staff since 1945, is now with the Chicago sales office. He joined CB&I in 1937. James R. Mansell who has been with CB&I since 1955, transferred to the Houston sales office from Birmingham, Alabama. George M. Rowley, a CB&I employee since 1955, moved from Hillside, New Jersey, erection district to the Boston sales office.

W. B. Campbell F. R. Anderson R. F. Schaffer R. W. Keener John Zauner

F. H. Maloney Company: William B. Campbell is new advertising manager. He was formerly with Graybar Electric and the *Houston Chronicle*.

Johns-Manville Corporation: A. R. Fisher has become chief executive officer. He was named chairman of the board, and continues as president and director.

Gardner-Denver Company: Floyd R. Anderson, chief metallurgist, Denver division, is now assistant manager of the division. He has been chief metallurgist since 1937, and is succeeded by Richard F. Schaffer, assistant metallurgist.

Lane-Wells Company: R. W. Keener and John H. Zauner were elected vice presidents. Keener has been coordinator of foreign sales-service, Zauner was recently technical assistant to the president of Lane-Wells.

R. H. Forsyth R. P. Stuntz F. C. Catron W. J. Williams Grover Kilgore

McNamar Boiler and Tank Company: Fred C. Catron was named manager of the company's special sales division and William J. Williams sales representative for new sales offices in Houston, Texas. Catron has been with McNamar 6 years and was previously with National Tank. Williams was with Stromberg-Carlson.

Babcock and Wilcox Company: Robert P. Stuntz was named assistant sales manager, refractories division. His headquarters will be in New York. Succeeding Stuntz as manager of the division's Chicago district sales office is Robert H. Forsyth.

Halliburton Oil Well Cementing Company: Grover Kilgore, vice president for sales and advertising, has been elected a director of the American Petroleum Institute. He is president of Petroleum Equipment Suppliers Association.

International Business Machines Corporation: McLain B. Smith has been appointed assistant general manager of the data processing division. He had been director of plans and control. Gilbert E. Jones was named manager of marketing and service. He had been sales manager of the division. Reporting to Jones will be Robert W. Hubner, who has been made sales manager, and William F. Gerken, who continues as manager of data processing customer engineering. Charles R. DeCarlo, has been appointed director of sales service. Robert T. Samuel, is the new director of marketing programs, William W. Simmons, director of product planning, and John E. Zollinger, director of sales administration. All continue to report to Jones.

Chain Belt Company: L. H. Bosnian, director, has been named to the board of directors, succeeding J. C. Merwin, retired. Bosnian has been with the company since 1919.

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Clark is now factory-installing STITT new Triple Ignitor Spark Plugs in Turbo Charged engines . . . Bring your Clark engines up to date—repower them with STITTS which give you longer life, cut downtime, increase magneto life. STITTS are also factory equipment in Waukesha, Cooper-Bessemer, Worthington, other leading engines

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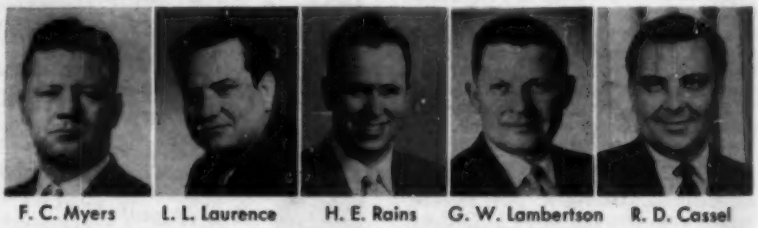


F. C. Myers L. L. Laurence H. E. Rains G. W. Lambertson R. D. Cassel

Black, Sivalls & Bryson, Inc.: Floyd C. Myers, manager of sales and service, Oilfield Equipment Division, was elected vice president and manager of oilfield sales; Lawton L. Laurence, manager of engineering, Oilfield Equipment Division, engineering vice president of BS&B and will serve in a staff capacity. William F. Gates, director of purchases, purchasing vice president, and will serve in a staff capacity.

Philco Corporation: John R. McAllister is new manager of purchasing, government and industrial division. He replaces William MacMurtrie, retired.

Well Equipment Manufacturing Corporation: I. D. Abshire has transferred from North Texas area to Rocky Mountain territory with headquarters at Casper, Wyoming. Don Wilson will move from Casper to Wichita Falls, Texas, from where he will serve the North Texas area.

Lunkenheimer Company: George W. Lambertson, formerly Chicago branch manager, has been promoted to a divisional sales manager. Jack W. Montgomery, sales representative at Chicago, succeeds Lambertson as branch manager. Melvin W. Pauly, vice president, will be assisted by H. Ewell Rains, with Harold H. Layritz and Lambertson as divisional sales managers.

Continental-Emsco Company: Robert D. Cassel is new district manager. Former division production machinery specialist, Cassel joined company in 1948. A. L. Beavers, former production machinery specialist, is new district production machinery specialist; Ray Atchley, drilling equipment specialist for Wichita, Kansas, district office; Ben L. Grace, district tubular representative, Corpus Christi, Texas. New D+B specialists: N. P. Burkett, Laurel, Mississippi, store; Robert L. Hicks, Snyder, Leroy Polk, McCamey, and Jesse E. Dennis, Winnsboro, Texas.

Of Things To Come . . . In Oil

NEW FLURRY OF MISSISSIPPIAN TESTS in Paradox Basin are to get underway as a result of successful completion of Pure Oil Company's No. 1 Big Flat, San Juan County, Utah — first Mississippian producer in that state. Two other tests in area, south and west of Moab — if successful — would give zone sufficient reason for substantial exploration. Pure's well flowed 319 bbl daily from 7694-728 ft; other tests being drilled by Federal Oil and McRae Oil & Gas.

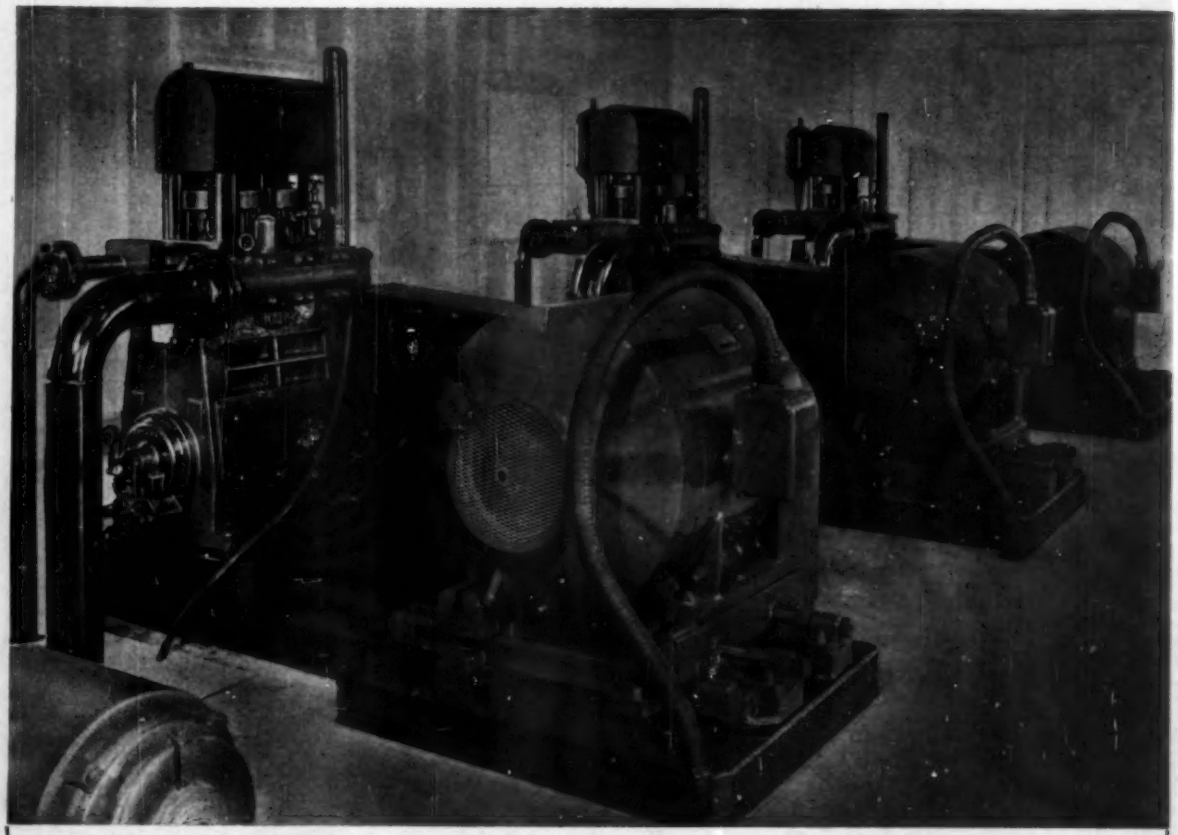
PETROLEUM DEMAND WILL EXCEED SUPPLY within next 15 to 20 years, says independent M. B. Rudman of Dallas, just returned from three-month study of future oil consumption in Europe. Growing population, European's desire to raise standard of living, increased importance of petrochemicals and new oil requirements in field of atomic and solar energy are listed as reasons for upsurge.

UPHILL BATTLE TO FREE INDEPENDENT GAS PRODUCERS from government control expected this year, as a result of Denver Court of Appeals decision upholding FPC's right to regulate gas prices at well head. U. S. Tenth Circuit Court denied petition by Saturn Oil & Gas Company, Kansas producer, who had hoped to show it was not a natural gas company as defined by Federal Natural Gas Act. Issue was regarded as major test case of validity of Supreme Court decision in the Phillips Case.

VOLUNTARY OIL IMPORT SCHEDULES TO BE MAINTAINED for some time to come, as both importers and many independents see hazard of government control. Record for last three months of 1957 indicates full cooperation and understanding of most importers. So long as import schedules are not greatly exceeded, government will not impose stringent regulations.

STANDARDIZATION OF RADIOACTIVITY LOGS is in the offing, and API now has committees formed to study best approach. Idea proposed by producers is to have these logs on a comparable basis with electric logs, permitting correlation of different service company radioactivity logs.

TEXAS PRODUCERS ARE NEARING A PACIFIC COAST OUTLET in form of long-discussed crude pipeline. Texas lawmakers are pushing program with producers, and getting aid through imports hearings in Washington heard early in December. Texas legislature passed resolution asking Federal Government to look at "West Coast shortages" and suggested a Louisiana line. Testimony heard by Captain M. V. Carson suggested government approval for financing such a line.



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PUMPS: 24 Aldrich Direct Flow Triplex

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FINDING OIL TOMORROW

. . . Where Are Our Future Reserves Coming From?

A team of four outstanding exploration men consider this question in a panel discussion at the 27th annual meeting of the Society of Exploration Geophysicists in Dallas, November 11-14.

Here are some clues from the experts . . .

1. **Foreign Exploration**
2. **Offshore Reserves**
3. **New Techniques**
4. **Re-Evaluation of Existing Data**
5. **Imaginative Thinking**

Tripp: In what geographic area of the world are the best possibilities for finding new oil?

Hamm: Since 75 percent of the known reserves of the world are in the Middle East, considerable attention will be given in the future to that great basin which has not been fully explored at this time. *Potential in foreign areas does outweigh potential at home as we see it today.*

Tripp: If we had to focus our entire efforts in North America, do you think that our best bets would be deeper horizons, offshore, stratigraphic traps in basins which have been exploited, structural traps, or in some neglected region which hasn't already been investigated?

Cortes: For tomorrow's oil reserves in North America, some of the best areas are the offshore or Continental Shelf Provinces. Two best areas based on present knowledge are offshore Louisiana and California. Texas and some other states — Mexico, Central American countries, and Cuba — are less important at this time. All will agree that total of offshore oil reserves as well as gas will be very substantial.

Economics will govern the finding and production of offshore areas. Most offshore operation costs at present are two to five times those on land. *For tomorrow's oil exploration, offshore drilling and production operations probably can be done at any distance from shore and probably in excess of a thousand feet water depth at a price.*

Worldwide, the Continental Shelf hydrocarbon reserves are very great. One estimate, not mine, is 400 billion bbl of oil or two-thirds of the ultimate world land reserves of 600 billion. For tomorrow's use, the amount of offshore hydrocarbon exploration and production will be determined by need, results of research and development, operation costs, oil and gas selling prices, and last but not least, favorable or unfavorable government regulations.

Woods: I imagine everybody here knows that the deep waters from Galveston down to Mexico have been quite disappointing. **Is there any chance that by drilling more wells or by drilling deeper, we might eventually make something out of the rather disappointing waters off Texas?**

Here are the panelists: From left to right, W. Dow Hamm, general exploration manager, The Atlantic Refining Company; Eugene McDermott, board chairman, Texas Instruments, Inc.; Maurice Tripp (panel moderator), president, Tripp Research Corporation; Henry Cortes, vice president and research director, Magnolia Petroleum Company; John P. Woods, geophysical laboratory director, The Atlantic Refining Company. All are from Dallas, Texas.

Hamm: I would assume that there will be oil in offshore Texas. I have assumed that and I've been somewhat mystified at some of the results. The facts of the case as seen today are simply that the offshore Texas region is not as oily as offshore Louisiana. I think there is a lot we don't know about Texas waters, and it may be that the near-shore region which has been explored to date is not exactly the right belt of country to look at.

Tripp: Can we say that tomorrow's offshore possibilities don't necessarily look excitingly attractive compared to what we have found so far?

Hamm: No, I don't believe you would say that. The tremendous reserves indicated offshore and which will be found there in the future give us a very great feeling of safety from a national standpoint. It is a place that can be drawn on much more heavily as these pools are blocked out and a certain number of wells are drilled. It gives us a place to build up very substantial production if and when we ever have another national emergency. I think it's a very fine piece of insurance.

Woods: I want to go back to the water offshore Texas. *I've got a strong suspicion that the oil in deep water 15 or 20 miles off the coast of Texas is probably 20,000 or 25,000 ft deep and that we have not been going deep enough. What do you think of that?*

Hamm: It would be an interesting thing to investigate at some time in the future. However, I doubt very seriously that it is going to be probed any time soon.

Tripp: We would be interested in what the panel thinks about the importance of tar sands and oil shale, which are also potentially a domestic source of hydrocarbon in providing tomorrow's oil. Can we expect commercial developments from those sources any time soon?

McDermott: They are now being commercially developed — both tar sands and oil sands.

Hamm: Recent papers on that subject have put oil-shale oil not too far out of the ball park with normal crude oil. And I think that there may be a time in the future when it will be competitive.

McDermott: But, if the price is anywhere near the ball park at this stage of the game, that's something for us exploration people to worry about.

Hamm: I think it's not so much a worry as it is again a safety factor for the nation. I am not an oil shale expert, but from what I read it would seem to be a competitor for petroleum.

Woods: I would like to draw attention to the large amount of shale-oil which is in Colorado, Utah, and Wyoming. I saw an estimate the other day, or rather a revision of a previous estimate. The previous estimate was 150 billion bbl; the revision was 300 billion on the basis of additional core drilling . . . rather a fantastic amount of oil. But the picture is not as pretty as it sounds when you think about those reserves. It's a wonderful thing to go out in the field and spin a valve and have oil come up, but this oil shale has got to be mined. What you get out of it incidentally is a queer form of oil which is probably going to be hard to refine.

Tripp: During the past 12 months, the United States has produced 25×10^{15} Btu's of energy in the form of petroleum. During this same period of time, the U.S. has produced domestically or purchased from abroad $8\frac{1}{2} \times 10^{15}$ Btu's of energy in the form of uranium. In the nine years of growth of the uranium industry, the unit price that we have paid for a million Btu's in the form of uranium is 2 cents. Unit price for a million Btu's of energy in petroleum is 35 cents. **Considering at the moment that we are explorers for energy, do you think that the explosive growth of the uranium producing industry might overshadow oil exploration, particularly if the price to producers were anywhere near comparable instead of the spread which they now have?**

McDermott: If you can produce energy from uranium or any other source at a price you can sell it, the only advantage of petroleum and natural gas is for liquid fuel which you can use for a large demand in mobile units. This is, I think, a pretty broad question.

Woods: Uranium as a bogey-man doesn't worry me. *I can see that it will not be very long before a rapidly increasing petrochemical industry will use all the petroleum we can find, uranium or no uranium.* Besides that, as long as you have automobiles, you've got to lubricate them and you're not going to do that with uranium.

Tripp: Well, let us pass on to the subject of exploration philosophy. **We would be interested in the opinions of panelists as to whether we are now using our data, our manpower and/or our instruments in the most effective way. Do we have to think about changes to meet the challenge of tomorrow?**

McDermott: I would say that we are not even collecting our data well. Most of our data are seismograph data. It's imperative that we store these data with minimum distortion, otherwise how are we going to use them later if you develop techniques for processing data. This means the data should be recorded on a very broad-band amplifier with detectors that are free from distortion. This is the very first step, and we are not doing this, and if we don't do this, there is no use talking about what you are going to do with it later.

Tripp: There is also a matter of enormous amounts of data from dry holes.

Hamm: Yes, I think probably we are storing a lot of geologic data. I don't think by any stretch of the imagination that we are perfect in the way we use this information. We are drilling over 50,000 wells in the ground each year. We are doing a tremendous amount of seismic work, gravity, mathematics, and electrical work. Of course, the study of all of these data is a time-consuming thing and that again costs money.

Henry C. Cortes Succumbs in Honolulu

Henry C. Cortes, 65, a vice president and director of the Magnolia Petroleum Company, died of a heart attack December 6, 1957, in Honolulu, Hawaii, en route to Taipeh, Formosa.

A past president of the Society of Exploration Geophysicists, Dallas Petroleum Geophysicists, Dallas Geophysicists, Dallas Geological Society, and Dallas Petroleum Club, Cortes held numerous national professional offices. He gained international recognition for his work on offshore oil exploration and fundamental research. He was in charge of Magnolia's field research laboratory and offshore operations coordination, and had announced plans to retire January 1, 1958. He had lived in Dallas since 1937.

His participation in the panel discussion at the recent SEG meeting in Dallas was his last public professional appearance.

Tripp: Do you subscribe to the idea that if you don't learn anything from your dry holes that you shouldn't have been so stupid as to drill them in the first place?

Hamm: Of course, you want to be sure the wells are dry. I think I've seen some figures recently where *re-entered dry holes had about as high a batting average as the wildcat wells that we have deliberately drilled within the past few years,* which isn't too good a recommendation for our overall effort in the industry to find oil in wildcat wells.

Woods: I think you asked one of the easiest questions that possibly could be asked. Are we using our seismic data perfectly? The easiest answer in the world is the obvious answer . . . no, of course, we aren't. There's far more information on seismic records than is ever taken off. Some of the information which is taken off is taken off incorrectly. *There isn't a company in the business that hasn't put an oil field in its files and let it stay there four or five years and then brought it out when somebody else proved that the field was there.*

McDermott: Unless we start objective procedures prior to the picking of the reflection, we'll never get much out of the records. This can be done. We have been experimenting with putting seismic data on IBM cards. We've been able to tape the record through an analog digital device and reproduce and pick reflections by setting up criteria. I think that that is what we've got to do. I don't say that this can be done economically. All I say is that it can be done, it is an objective way of doing it, and if it is going to be economical it means we must develop instruments to speed up the process.

Woods: I think magnetic tape is wonderful, I'm thoroughly in favor of putting our seismic records on tape, I'm in favor of playing back that tape in cross-sections, with the corrections made with different filters, and I'm even willing to have the machine pick certain simple reflections, but I still think that *far superior to any machine and by far always the dominant element in exploration will be human judgment.*

McDermott: The man has to program the machine, of course. I merely suggest that if we don't do this, what are we going to do, and if we don't do something different from what we're doing, we're sunk.

Tripp: If you were hunting for oil in an entirely new province, and you had no previous prejudices to guide you and you were an intelligent man with the aid of all the machines which were needed, but the judgment here rests with the human being, what would be the initial step in exploring this unexplored petroliferous area potentially?

Woods: The first thing I would do would be to send a surface geologist in there. Just as quick as he gave me any sort of a structure, I would put down a well and see how much section I had and also to see if by some stroke of luck I might get an oil field on the very first try. After that, I would do my geophysics.

Hamm: What you do first depends on what you're working with. If there's any geology to be observed at the surface, or you can see anything as to the nature of the rocks, you naturally want to look at them and size up the potential of the area and see what kind of reservoirs, if any, you have and whether it looks like there is a source formation. Aerial photography has come a long way in the last 25 or 30 years and you can see so much so fast. In a lot of virgin basin areas this might be one of the first approaches to consider.

I think the idea of early drilling in a frontier basin has a lot of merit. Naturally, you would like to drill on some sort of a prospect. But even without that, I believe the trend of thinking on the part of the industry is toward early drilling in these little-known basin areas, especially in foreign countries.

McDermott: Exploration is essentially an up-grading procedure. That means you want to start with something that's cheap, that gives you a once-over-quickly. I don't think we have at all fully exploited the Gulf magnetometer, for instance, flying it in an airplane in foreign areas. Something else that might be useful is the Cagniard method, in which one measures the rate of change of magnetic and electrical fields at right angles to each other. Cagniard's method will give us unique depths to the top of the basement and therefore you don't have to do continuous profile, and that means you could get your equipment into spots where you need it with helicopter.

Another thing, of course, is the gravity meter that we have been using to some extent. Color aerial photography might be extremely valuable. Color film is expensive but will get cheaper as more of it is used for this purpose.

Woods: When we go into new basins as we now are doing, we should go back and take a new look at our old methods. In particular, you mentioned the electrical method. I feel very strongly that it has never been fully developed. I feel fairly sure that it is only by accident that the refraction seismograph was used to discover the shallow salt domes through Texas and Louisiana. In all probability, the electrical method could have found those domes and found them more quickly and more cheaply.

McDermott: In speaking of the use of any method that will contour the top of the basement or the bottom of the sediments, I can't help but feel that in many cases any faulting or structure in the basement will be reflected in many cases in some way in the sediments. Not in detail, of course, but this could be a way of picking up trends in the basement that would be structural trends in the sediments . . . which would be a further high-grading.

Tripp: Suppose we shift our attention a little toward the discussion of earth properties as they apply to some of these measurements. We make lots of measurements on rocks, utilizing density and elastic modulus, electrical resistivity, dielectric constant, magnetic susceptibility, radioactivity, temperature, etc. For the most part, our use of these data has been confined to recognizing the presence, the absence or the attitude of certain rocks, and this is dependent upon differences between different types of rocks. **Are we neglecting any properties of the rocks in addition to these we are now using that might be helpful, that ought to be explored in the future?**

Cortes: I think one of the things we probably need more of now than at any time is some additional fundamental or basic research. And, from that fundamental research may come some surprising new possibilities in methods of finding oil. It should also improve all present methods we have.

Woods: One major company has actually found two or three oil fields by measuring temperatures and I strongly suspect that we have not yet made full use of temperature measurement as a surface exploration tool for oil fields.

Tripp: What about such things as age of the sediment? We've begun some measurements here in recent years to determine the age of certain types of sediments. **Do you think that it would be particularly advantageous in finding more oil if we could run an absolute age log so that we would have a measure of rate of sedimentation of the individual formations, the presence of unconformities, faults, etc.?**

Woods: If, by that, you mean that by running some instrument down a hole on a wire line we could get an absolute log, an accurate log of the age, it truly would be wonderful. First of all, it would settle many a geological argument, it would locate many a fault, and it would give you a new device for correlating one well to the next.

Tripp: We usually neglect inquiring into the geological processes which give rise to the physical properties that we measure with our geophysical devices.

For instance, what geological process is disclosed by investigating the lateral and vertical variations in seismic velocity and how are these related to sedimentary facies or post-genetic changes that might be indices or indications of petroleum? Do you think that developments like this are indicated for future developments of the seismograph, for instance, or are we talking about tomorrow's seismograph being just a polished version of today's with higher degrees of refinements?

McDermott: The answer to that is theoretical for me, but I will say that I think we've got a start at looking at this seismograph differently. We have been refining and refining and unless we get some radically new procedure our refining is, I think, at the point of diminishing returns.

Woods: Besides being troublesome, seismic velocity variations are an indication of structure. Every big structure in West Texas is indicated by velocity anomaly, so if you had some means of doing nothing except measuring underground velocity, you would have found these structures. We are slow to make use of some of our tools. Only a short while back, the continuous velocity log came into being. And I've been astonished at the slowness with which we have taken it up, and I am still very strongly of the opinion that we are nowhere near using the continuous velocity log as much as we should be using it.

Also, I wonder why it is that we make so little use of the amplitude of a reflection. Here is reflection "A" which is big and strong, followed by reflection "B" which is weak. Why? Isn't that information? Or, you are following reflection "B" across the country and in a band of one or two miles it becomes a bit weaker. Does this possibly indicate porosity? Why don't we make more use of relative amplitude?

Tripp: Do you see any new type of instruments for measuring anomalies of chemical, physical or biological properties that we might use in oil finding?

McDermott: The application of instrumentation to structural exploration was quite logical and very rewarding. It seems to me that it is equally logical to apply instrumentation to geochemical exploration. It might be equally rewarding. This might turn out to be one of the reconnaissance techniques that we need so badly.

Tripp: I would like to give the panelists an opportunity to say anything which is unsaid which they have on their minds, which they think is pertinent or impertinent . . . and also maybe to get in that last word that they were interrupted on.

Hamm: We've touched on a lot of different things here . . . but the important point in finding oil is to find oil and make a little money at the same time. If you don't, you're going out of business. I think *we all have a pretty serious question in front of us . . . how to find oil in the United States on which we can hope to make a profit and compete with the relatively cheap oil that is being found in foreign areas.*

Cortes: I'm one of those who thinks there's a lot of oil left in this country. I do think we need either new methods of finding a lot of oil that we haven't found yet . . . or we need many improvements on the instruments we already have and the methods we already have to find this additional oil. Of course, a lot of that oil would be stratigraphic and in that connection I also bring up again the fact that *I think we need a lot more research, both fundamental and applied, and plenty of experimental work behind all of that.*

McDermott: I would say that for effective exploration, we must use multiple techniques. That is especially so for relatively unknown foreign areas and it still holds for our domestic areas. And secondly, to be sure we are getting the maximum of significant data, we must be certain that we are properly processing those data . . . especially, *we must be sure that we are making maximum use of the rather new facilities that are offered us by the computing machines.*

Woods: We are going to have trouble finding oil in the United States . . . even though it may be much easier in some of the new areas. However, I don't think we are going out of the oil business. I do believe we are going to find some fields right in the middle of our dry holes. *I'm sure we are going to find quite a few fields deeper,* and I don't believe it will be too long before wells of 20,000 and 25,000 ft will not be too unusual. I think *we do have at least a few pioneer or semi-pioneer areas in the United States:* Utah, Alaska, and quite close to us, Canada, which is already one of the great oil producing countries of the world and promises very much in the future. I'm not at all afraid that the geologists and geophysicists will ever be driven out of work by machines.

There isn't any excess oil in this country. We forget that about 10 percent of the world's reserves are in the United States . . . about 70 percent of the world's reserves are right around the Persian Gulf. I've got a strong suspicion that it won't be many years before it will be established that there's just as much oil in the Sahara as there is around the Persian Gulf . . . and when that time comes, our percentage of the world's reserves won't be 10 percent . . . it will be 3 percent.

Tripp: Whether our exploration activities involve a new or improved method of measuring an earth property or a method of analyzing and interpreting data having greater rigor, sophistication or complexity doesn't seem to be the only answer for finding oil tomorrow. I would gather from our conversation here this evening that you might all agree on one point: That **tomorrow's oil is mostly to be found by imaginative thinking, using the tools we have, plus the refinements that can be made to them,** guided by aggressive concepts rather than past prejudices. ★ ★ ★

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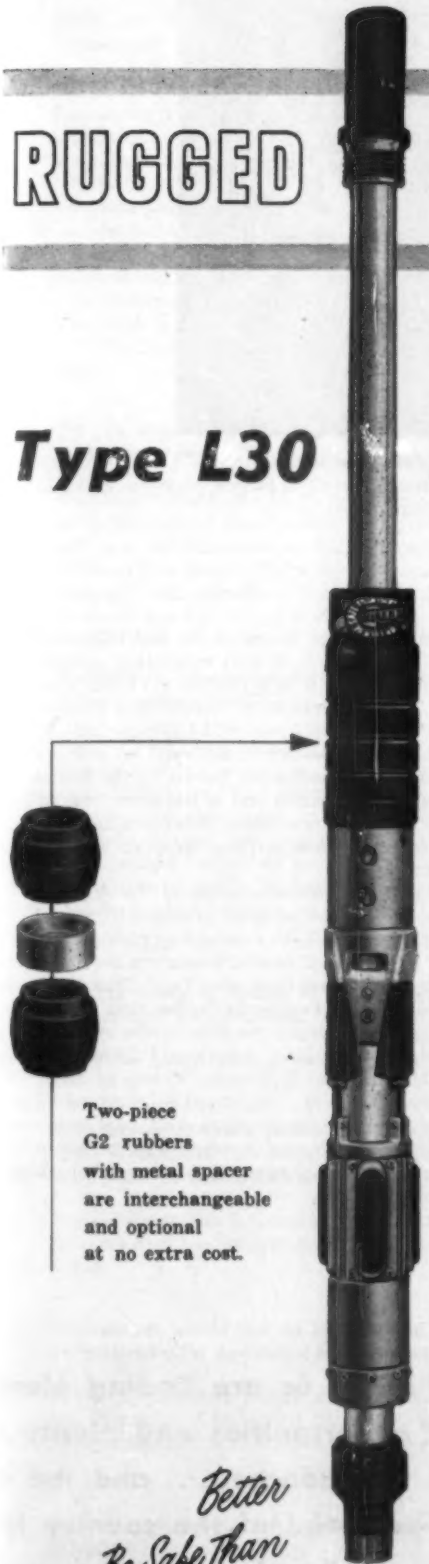

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An interview with **Cecil V. Hagen,** *one of a few independent oil men active in Venezuela*

"The future looks fine" for U. S. companies in Venezuela, says Cecil Hagen, president of Talon Petroleum C. A.

An Independent Looks at Venezuelan OIL

Cecil V. Hagen is one of the first independent oil men from the U. S. to start widespread oil operations in Venezuela. He is president of Talon Petroleum C. A., a strong integrated independent company that bought out British Controlled Oilfields, Ltd., in 1952.

Using U. S. developed methods, his new company improved the concessions owned by the British firm, increasing production and at the same time effecting economies that are necessary for black ink operations. His company is also carrying on an active exploration program.

Hagen is an active member of the Association of when he resigned as chief geologist of Superior Oil Company in 1940. As a consulting geologist and engineer, he organized several producing and exploration companies. Among them were Gulf Coast Leaseholds, Inc. and Falcon Petroleum Corporation.

Hagen is an active member of the Association of Petroleum Geologists, American Institute of Mining and Metallurgical Engineers, Society of Exploration Geophysicists, and a Registered Professional Engineer in the state of Texas. He was a director of Independent Petroleum Association of America from 1940 to 1953.

He attended Columbia University and the University of Oklahoma.

"Sometimes, the only way to sell oil is to cut prices. Unlike the U. S., there is no such thing as 'ratable take' and 'posted field price'."

"We consider ourselves lucky if we are able to produce oil for only $1 per bbl."

"All of us are finding plenty of opportunities and plenty of headaches . . . and the oil potential of the country has barely been scratched"

Q. How are things for independent oil operators in Venezuela?

A. There are only a few of us independents operating in Venezuela thus far — and all of us are finding plenty of opportunities and plenty of headaches. On the bright side, there are numerous top geological prospects — the oil potential of the country has barely been scratched. Moreover, the production allowables are high, limited mainly by the MER for the various wells.

On the dark side of the picture there are two big difficulties that independents must solve individually in order to operate profitably in Venezuela: First, he must find transportation for his crude, and second, he must find a profitable market for it. These things are not easily come by in most instances.

Q. Do you mean that the independent must solve these problems by himself?

A. Absolutely. Unlike the U. S., there are no such things as "ratable take" and "posted field price." The fact that there is a pipeline near an independent's production does not mean that he can obtain shipping space in it. And even when his crude does reach dockside, he must compete for his share of the fluctuating world market.

Q. Aren't there Venezuelan laws that can force pipelines to make space available?

A. There are laws that *seemingly* solve this problem, but the loopholes are larger than the pipelines themselves. In essence, the laws say that when a pipeline is not being utilized to capacity, the unused space must be allocated to other would-be shippers. But, keep in mind that the production rate is high in Venezuela and any company that has sufficient reserves to justify the high cost of constructing a pipeline, can produce enough oil to operate the line to capacity.

Q. In other words, a pipeline is not necessarily a "common carrier" in Venezuela.

A. Not as we know common carriers in the U. S.

Q. Does this mean that a pipeline owner company with offset production, can drain another operator, using their own pipeline to accomplish this?

A. Yes. However, this is something of an extreme case. I am not sure it has actually happened, but it is possible in any event.

Q. Summed up, would you say that owning a pipeline is a prerequisite for successful independent operations?

A. If the independent's properties are in the interior — yes. Of course, if he is near the lake (Maracaibo) or near water transportation, his problem may be easily overcome.

Q. Does the availability of pipelines affect your own operations?

A. Yes. The fact that we own a 4 to 6-in. pipeline system running from our production to a deep water terminal, definitely affects our area of operations so far as exploratory and development drilling is concerned.

Perhaps I'd better explain that the company I head — Talon Petroleum C. A. — should be classed as an integrated independent company. It was organized in 1952 for the express purpose of buying out British Controlled Oilfields, Ltd. This was one of the oldest companies in Venezuela; it actually carried out geological exploration as early as 1912. At the time we took over, BCO had concessions totaling about 3000 hectares (7410 acres). In addition, it had pipeline facilities and a deep water terminal.

Q. Will you give us a brief rundown on the activities of your company?

A. Our company owns eight concessions in Venezuela — all of them acquired from BCO, and located in the district of Mauroa in the state of Falcon. All of the concessions run for a period of 40 years from 1945 and carry a four percent royalty on present production. El Mene field, located 40 miles east of the city of Maracaibo, is the principal producing field with 59 wells averaging approximately 1600 bbl per day.

Talon's main camp and the company headquarters are located at El Mene. The camp is fully equipped with warehouses, machine shop, carpentry shop, saw mill, electric generating plants, natural gas and other facilities you would expect to find in the U. S. In addition, we maintain housing units, a school, a hospital, commissary, swimming pool, club, and other necessities for Venezuelan operations.

Q. Excuse me for breaking in, but did you say that schools and hospitals are necessities?

A. Absolutely. Venezuelan law requires that we provide every local employee with housing, schools, hospitals, and other facilities necessary for his well being.

Q. Does this greatly affect the economics of operations?

A. Yes, but the degree depends on the amount of crude produced. In our case, we consider ourselves lucky if we are able to produce crude for only $1 per bbl. However, if we had twice as much production coming out of the same wells, we could possibly produce it for 60 to 70 cents per bbl.

Q. Getting back to your own set up, where is the rest of your production?

A. At Media field, 3½ miles northeast of El Mene, Talon has two wells producing about 75 bbl per day and at the Hombre Pintado field, 10½ miles northeast of El Mene, the company has a daily average production of 520 bbl from 23 wells. The currently non-producing concessions total about 1190 hectares and are located in the same general area on promising geological structures.

Q. Do independents in Venezuela ever obtain farmouts from large companies?

A. Yes. As a matter of fact, we have a 2818-hectare farmout from Compania Española de Petroleos, S.A., a Spanish company with substantial refining interests in Cartegen and the Canary Islands. This block (about 7000 acres) has two attractive geological structures on it according to seismographic surveys. Talon has started a 15,000 ft wildcat on this property.

I should add that Talon owns some 39,000 acres of land in fee.

Q. Are farmout arrangements in Venezuela similar to those in Texas?

A. Yes. As you know, the farmout provides the means of spreading the risks of exploratory drilling. In the U. S., the independent has always supplied the "good offices" for making deals whereby one company can give up a portion of its acreage as payment for an exploratory well. It is common practice for companies owning nearby lands to contribute "dry-hole" or "bottom-hole" money to the wildcat. Our own company's practices in Venezuela hew somewhat to this same line.

Q. Is financing in Venezuela similar to that in the U.S. too?

A. Yes. It is well known that the independent has always operated on bank loans. In other words, he mortgages his reserves to pay for the drilling of wells necessary for the development of his properties. This same practice is followed in Venezuela with the exception that the independent mortgages sales contracts and must show that transportation to market is assured.

Q. Speaking of sales, do you find it very difficult to market your company's oil?

A. Yes. In fact, this is perhaps the most exciting and exasperating aspect of independent operations abroad. Crude prices fluctuate widely, depending on world conditions. Sometimes, the only way to sell oil is to cut prices, but there are times when favorable deals can be worked out quite advantageously.

Q. Will restrictions of U. S. imports affect your company's operations?

A. Absolutely!

Q. Will you describe just what you think a good U. S. import policy would be?

A. A fair "shake" for all newcomers who are "breaking the ice" in foreign operations. By that I mean a decent import quota if they find oil since they are venturing away from pipeline connections and all other conveniences of operating at home. They should know that they can bring crude into their own country since they are following the government (U. S.) directives of private investments in other countries.

Q. Do you think oil will eventually become a glut on the market?

A. If you mean do I think other forms of energy will supplant petroleum some day, the answer is yes. However, when that time comes, petroleum will have become too valuable a chemical to burn. I think disruption of the market from this direction is remote in the forseeable future.

Q. Do you think U.S. companies will fare well in Venezuela?

A. Yes, indeed! The future looks fine because we have a rising energy consumption, and the day is not far off when the U.S. will be forced to import a great percent of the crude it uses. Strong U.S. independents in Venezuela can help and be as stimulating to the oil industry there as they have been at home. ★ ★ ★

AAODC Appoints Chairmen For 14 National Committees

Chairman and vice chairmen of 14 national committees have been named by the American Association of Oilwell Drilling Contractors to serve during 1958.

Appointments were announced from Dallas headquarters by President Jack H. Abernathy, Oklahoma City, and President-elect J. U. Teague of Houston, who will take office January 1, 1958.

Committee assignments are:

Accounting: Chairman, H. Don Johnson, Carl B. King Drilling Company of Texas, Midland; vice chairmen, F. E. Godfrey, Big Chief Drilling Company, Oklahoma City, and D. C. Anderson, Rowan Drilling Company, Inc., Fort Worth.

Cable Tool: Chairman, Ray Wiley, Ray Wiley Drilling Company, Carmi, Illinois; vice chairmen, Gail C. Culter, Culter Drilling Company, Tulsa, and Ferd J. Spang, Spang & Company, Butler, Pennsylvania.

Chapter Activities: Chairman, Don Slape, Don Slape Drilling Company, Olney, Illinois; vice chairmen, C. A. Norton, Norton Drilling Company, New Orleans, and Harry J. Schafer, Jr., Schafer Drilling Company, Oklahoma City.

Drilling Contracts: Chairman, Earle C. Hellums, Gracey-Hellums Corporation, Houston; vice chairmen, T. W. Wheeler, Loffland Brothers Company, Tulsa, and M. G. Rowe, Rowan Drilling Company, Fort Worth.

Education and Training: Chairman, H. W. Davidson, Davidson Drilling Company, Midland; vice chairmen, J. K. Kellogg, K. L. Kellogg & Sons, Compton, California, and J. J. Harrigan, Standard Drilling Company, Inc., Oklahoma City.

Insurance: Chairman, David Kimbell, Alan Drilling Company, Wichita Falls; vice chairmen, R. L. Manning, R. L. Manning Company, Denver, and Hunter Eakle, Eakle & Holder Drilling Company, Evansville, Indiana.

Membership and Dues: Chairman, Herbert Woolf, Woolf and Magee, Inc., Tyler, Texas; vice chairmen, J. Geer Wilcox, Circle Drilling Company, Inc., Lake Charles, and F. A. York, Miller & York, Bakersfield, California.

Publications: Chairman, George F. McQueen, McQueen and Stout Drilling Company, Fort Worth; vice chairmen, Gerald N. Eason, Fain-Porter Drilling Corporation, Oklahoma City, and A. J. Heiser, Brown Drilling Company, Long Beach, California.

Public Relations: Chairman, A. Earl White, Mustang Drilling Corporation, Tyler; vice chairmen, R. B. McCloy, Big X Drilling Company, Oklahoma City, and R. C. Tucker, Great Western Drilling Company, Midland.

Resolutions: Chairman, Jack H. Abernathy, Big Chief Drilling Company, Oklahoma City, vice chairman, E. Dale Mount, Harry Bass Drilling Company, Dallas.

Rotary Drilling: Chairman, B. E. Groenewold, Exploration Drilling Company, Tulsa; vice chairmen, M. M. Brantly, Brantly Drilling Company, Inc., Midland, and H. J. Magner, Rowan Drilling Company, Inc., Pittsburgh.

Safety: Chairman, John B. Holmes, Holmes Drilling Company, Houston; vice chairmen, Austin W. Mosley, Southland Drilling Company, San Antonio, and H. R. Bean, McAlester Fuel Company, Magnolia, Arkansas.

Taxation: Chairman, M. C. McBride, Camay Drilling Company, Denver; vice chairmen, M. Clay Chiles, Chiles Drilling Company, Alice, Texas, and James G. Adkins, Adkins Drilling Company, Inc., Great Bend, Kansas.

Transportation: Chairman, N. H. Wheless, Jr., Wheless Drilling Company, Shreveport; vice chairmen, C. E. Blount, Blount Drilling Company, Midland, and Carl T. Gates, Fowler Drilling Company, Long Beach, California.

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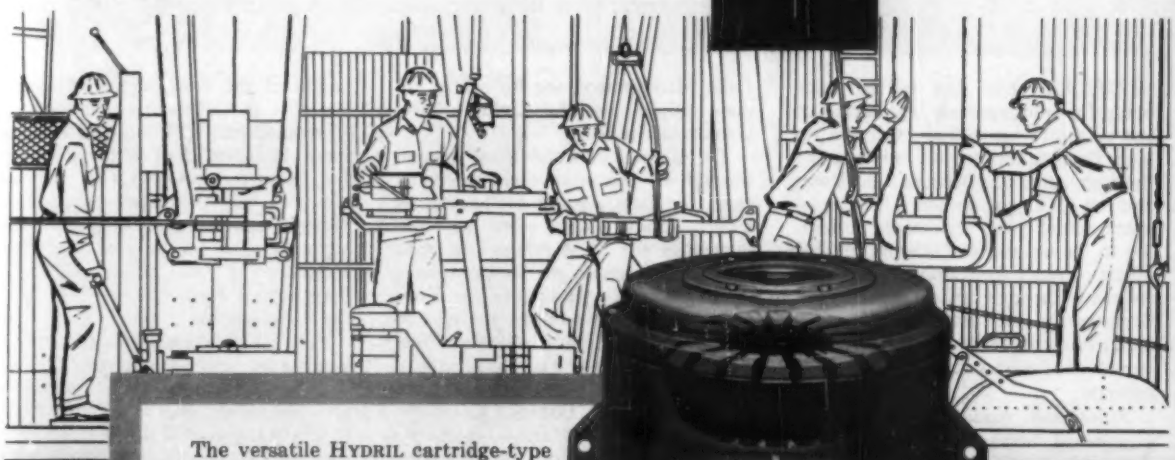

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HYDRIL TAKES THE BLOW OUT OF BLOWOUTS

C F R C F R C F R

PLAYING THE FOUR CORNERS ...BY THE RULES

C. R. Graham
Assistant Editor

Oil and gas regulations relating to various state and federal agencies — although temperate in themselves — demand close inspection and rigid conformity for oilmen undergoing a new experience in public lands operations

FEDERAL, state and Indian lands comprise approximately 93 percent of the currently active Four Corners region. Because this activity is in not one but four states, and because these states and the U. S. government are also assuming dual roles, regulations pertaining to the oil and gas industry are the object of meticulous study. These governments, through various agencies and departments, must act not only as regulatory or conservation bodies but sometimes as landowners and royalty owners.

Rules and regulations have been established, however, on such a basis that operators need not be apprehensive to enter into the Four Corners play. The agencies involved have set up procedures to avoid duplication of paper work and conflicting rules.

Planning Precedes Plunge

Before "making the plunge" into the new area, however, considerable study, planning and coordination with authorities is imperative. The operator should know the various agencies and their functions. Oil and gas regulations should be studied. **Personal consultation with both federal and state authorities is strongly advised.**

Federal Regulatory Agencies

All regulations on federal and Indian lands pertaining to oil and gas are administered by either the Bureau of Land Management, the Bureau of Indian Affairs, or the United States Geological Survey.

The Bureau of Land Management, through its offices in each individual state, regulates oil and gas leasing on federal lands. Lease sales are conducted by the BLM offices and lease bonuses and rentals on non-productive lands are paid to them. In the Four Corners area these offices are located at 1305 North Central Avenue, Phoenix, Arizona; 314 Federal Building, Salt Lake City, Utah; 357 New Custom House Building, Denver, Colorado, and Federal Court House Building, Santa Fe, New Mexico.

The Bureau of Indian Affairs, like the BLM, is a division of the Department of the Interior. This agency administers oil and gas leasing and manages royalties and rentals received from such leasing on Indian lands.

Of primary interest to oil producers are the oil and gas supervisory offices of the United States Geological Survey. The USGS is a branch of the Department of Interior. Recent changes within the confines of the supervisory regions of the oil and gas leasing branch have resulted in placing much of the active Four Corners within the southwestern region. Within this falls jurisdiction of oil and gas operations on federal and Indian lands in all of Arizona, all of New Mexico, San Juan County of Utah, and all the west ranges of the New Mexico Principal meridian in Colorado (embracing all of Montezuma, La Plata, Dolores, San Juan, Hinsdale, San Miguel, Ouray, and Montrose counties and parts of Mesa, Delta, Gunnison, Saguache, Mineral, and Archuleta counties). The regional office is at Roswell, New Mexico, and the district office at Farmington, New Mexico, will have direct supervision.

(The change consolidates into one supervisory region the jurisdiction over all oil and gas leasing and operations activities for all lands under the Navajo Indian Agency at Window Rock, Arizona, and the consolidated Ute Agency at Ignacio, Colorado.)

The oil and gas leasing branch of the Conservation Division of the USGS exercises regulatory and technical supervision of drilling and producing operations under oil and gas leases on federal and Indian lands. Duties of the branch include the inspection of leased properties to insure orderly and efficient development of oil and gas deposits through proper engineering control and laboratory assistance; maintenance of proper production records; determination of the royalty liability of each producer; estimation of petroleum reserves on Indian and federal lands, and enforcement of federal regulations to assure orderly development, best engineering practices, prevention of waste and safety welfare of workmen.

It may be well to note that federal

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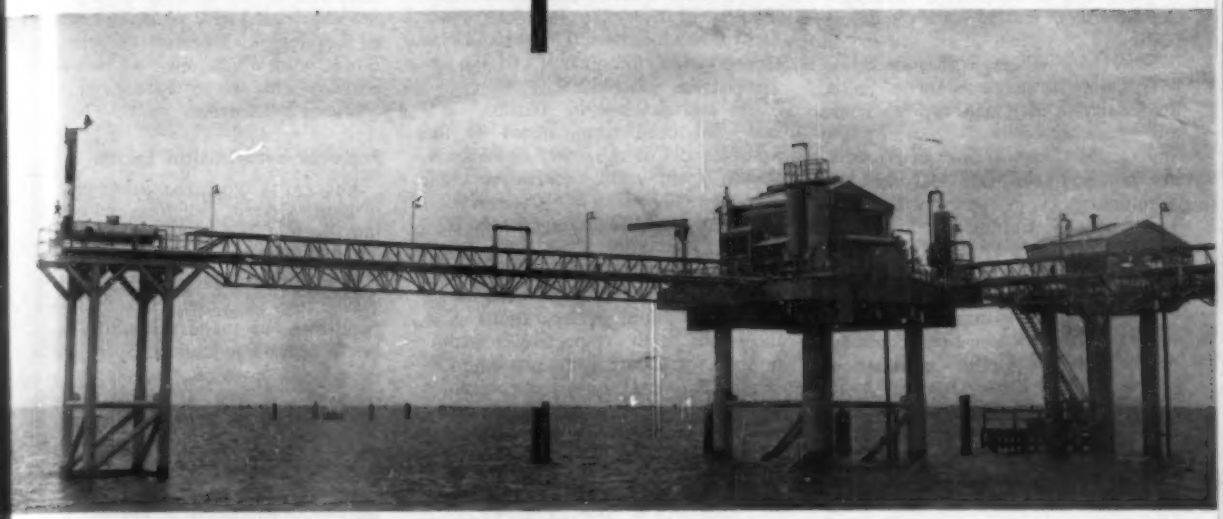

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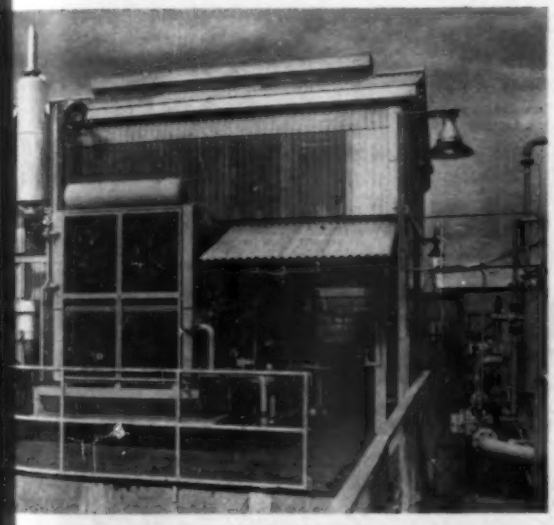

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lands outside San Juan County in Utah are administered from the district office in Salt Lake City, and all similar land in Colorado outside the west ranges of the NMPM are controlled from the USGS office in Denver. Both are in the northwestern region, with headquarters in Casper, Wyoming.

In the Four Corners, only New Mexico practices prorationing — in fact, Utah prohibits it

State Agencies

Each state in the Four Corners area has adequate leasing and regulatory bodies.

State land offices, with jurisdiction over leasing of their state-owned lands, are located in each state capitol. These are administered in Arizona by the State Land Commissioner in Phoenix, in Colorado by the State Board of Land Commissioners in Denver, in New Mexico by the Commissioner of Public Lands in Santa Fe, and in Utah by the Executive Secretary, State Land Board, in Salt Lake City.

Conservation groups: Each state maintains its own conservation body, and for the most part, organization, rules and purposes are similar.

In New Mexico the regulatory body is the New Mexico Oil Conservation Commission, with headquarters in Santa Fe. In the Four Corners area the commission maintains an office (District 3) at Aztec.

The Oil and Gas Conservation Commission of Colorado functions from Denver headquarters. The Oil and Gas Conservation Commission of Utah operates from Salt Lake City.

Oil and gas law in Arizona, until now, has been administered by the State Land Commissioner in Phoenix. Just in recent weeks, however, an eight member Oil and Gas Conservation Committee has been named by the governor of that state.

Ground water protection: In all four states ground water protection, as affected by oil and gas operations, is in the hands of the respective conservation bodies. Contrary to procedure in some other states, no direct communication to water engineers or the water boards is necessary before commencing operations.

OPERATIONS

Four Corners oilmen, as anywhere, find themselves working closely with the state and federal regulatory bodies. In this region, however, the question is not with which one, but what operation, with which agency, at what office, in what order.

Federal and Indian Lands

Paperwork must necessarily precede drilling. Certain bonding obligations must be met and operating agreements must be satisfied.

Bonding Requirements: Several obligations must be met. A $5000 lease bond must be made before drilling a single well on federal land. In lieu of these bonds, however, the operator may elect to make a $150,000 "nation-wide" oil and gas lease bond, or he may take a $25,000 "nation-wide" bond for all operations in one state.

Distinct from demands made for lease bonds on federal lands is a $15,000 collective bond for leases on Indian land. This may be waived by making a nation-wide oil and gas bond for $75,000.

Regulations pertaining to bonding and leasing requirements are contained in three volumes of the Code of Federal Regulations. Those pertaining to leasing may be found in Title 43, CFR; those dealing with USGS regulations are found in Title 30, CFR; rules for leasing on Indian lands may be found in Title 25, CFR. Details on the $15,000 collective bond for leasing on tribal lands may be found in Part 186, Title 25, CFR, for example. Requirements for the nation-wide Indian oil and gas bond are found in Part 186.6, Title 25, CFR.

Bonds covering operations on Indian leases are required when the leases are issued. Before drilling commences on federal lands, operations must be covered by the appropriate bond; bond coverage may be satisfied by submitting to the USGS office, for approval by the Bureau of Land Management (this sequence may be reversed) one of the following: A $5000 lessee's bond, $5000 operators bond by operator holding an approved operating agreement, or a nation-wide bond held by lessee or holder of an approved operating agreement.

Rules governing drilling: To drill a well on federal or Indian lands, an operator must be the record lessee, operate under a "Designation of Opera-

New lines of the Southwestern Region of the United States Geological Survey. This area includes all of New Mexico and Arizona, San Juan County of Utah, and all west ranges of the NMPM in Colorado.

" from the lessee, or operate under approved operating agreement. Before drilling commences, the operator must submit, in quintuplicate, sundry report "Notice of Intention to Drill," along with five copies of the location plat prepared by a registered engineer or surveyor showing the exact location of the well. Before this notice is approved, an engineer checks to see that the above mentioned bonding requirements have been met, the casing program is acceptable and that the spacing conforms to state regulations.

Sundry reports, in quintuplicate, showing intention of doing work such as setting casing, testing or other progress reports, must be submitted to this office for approval prior to commencement of the work. Upon completion of the work, subsequent reports must be filed showing details of the work done. If the well is dry, the USGS office must approve the abandonment and plugging program for the well. Whether the well is a producer or dry, "Log of Oil or Gas Well," form 9-330 in quadruplicate must be submitted, giving the history of the well.

Production reports: If a well is completed as a producer, the operator is required to submit a "Monthly Report of Operations," form 9-329 for a federal lease or form 9-329a, for Indian, and "Lessee's Monthly Report of Sales and Royalties," form 9-361 for federal or form 9-361a for Indian, in duplicate, each month thereafter.

Drilling, progress, completion and abandonment reports may be filed at the Farmington USGS district office, but the production reports (forms 9-329, 9-329a, 9-361, 9-361a) are submitted to the USGS regional office (P. O. Box 6721, Roswell, New Mexico).

Operations on State or Fee Lands

Most of the four states have similar rules and regulations covering drilling and well completions, and bonding requirements are somewhat simpler. Certain differences may be pointed out, however.

New Mexico: Bonding requirements that must be satisfied prior to drilling in New Mexico on either state or fee lands are primarily plugging bonds. In most instances, this is possible by making a $5000, one-well bond or a $10,000 state-wide bond. This must be secured from a responsible bonding organization within the state. A corporate surety bond will suffice. These must be satisfied before being permitted to file an intent to drill on state or fee lands in New Mexico.

Form C-101 is the basic form for this purpose, and when filing with the District 3 supervisor (120 E. Chaco Street, Aztec, New Mexico), this should be accompanied by form C-128. This form plots the lease and well location and is attested by a surveyor. Surveying in this entire region is the obligation of the lessee — and there are large portions of the Four Corners yet unsurveyed. Upon filing the intention to drill, the operator may proceed with verbal approval from the state supervisor. Other forms which are required during the course of the drilling and completion program include: C-103, various tests; C-105, which is a log of the well, submitted on completion; C-104 which is a request for allowable, and form C-110, authorization to transport oil and/or gas.

Before your first move into the Four Corners, personally consult members of the USGS and state conservation groups

New Mexico's oil and gas proration system is tied closely to well spacing. Basic well spacing in the Four Corners counties of San Juan, Sandoval, and Rio Arriba is 40 acres for oil wells and 160 acres for gas wells. Production is prorated upward and downward according to well spacing on tracts larger and smaller than the 40 or 160 acre base. That is, for oil wells, the top unit allowable for such well will be increased or decreased in proportion that the number of acres in the drilling tract bears to 40. The same holds true for gas wells.

It is well to note that New Mexico is the only state in the Four Corners area which practices oil proration. In fact, Utah statutes do not allow oil or gas prorationing. In New Mexico this is practiced on an individual pool basis.

Whether the well is drilled on federal, Indian, state or fee land within the boundary of the state of New Mexico, the Oil Conservation Commission has jurisdiction over oil and gas produced and transported.

Monthly reports of producers are made on form C-115 (oil, condensate and gas).

It is well to note that where production is on government land, the royalty-owner's share is calculated and the operator, in effect, is "billed" for the amount due.

As in any state, New Mexico makes many "exceptions" to the rules for individual field and well situations. For this reason the commission permits some qualified persons on the commission staff to be designated as examiners. An applicant desiring a field hearing may request the place of the hearing, and also request whether he prefers an examiner hearing or a hearing before the full commission. The OCC is made up of the governor of the state, the commissioner of public lands, and the state geologist (secretary-director). In the past, this arrangement with the governor acting as chairman of the commission, has kept the state government in close contact with the oil and gas industry, its problems and its objectives.

Arizona: Oil and gas law as administered by the State Land Commissioner O. M. Lassen, requires that a one-well bond of $2500 (or $10,000 bond for any number of wells on one structure) be made. These are plugging bonds, that may be waived by securing the nation-wide oil and gas lease bonds. Usual procedure is followed on proper state forms for filing intent to drill, operations procedure to be followed, well completion reports, etc. A complete well log is required within six months of completion, whether dry or productive. The new eight-man Oil and Gas Conservation Committee will play an increasingly important role in oil regulation and development within the state.

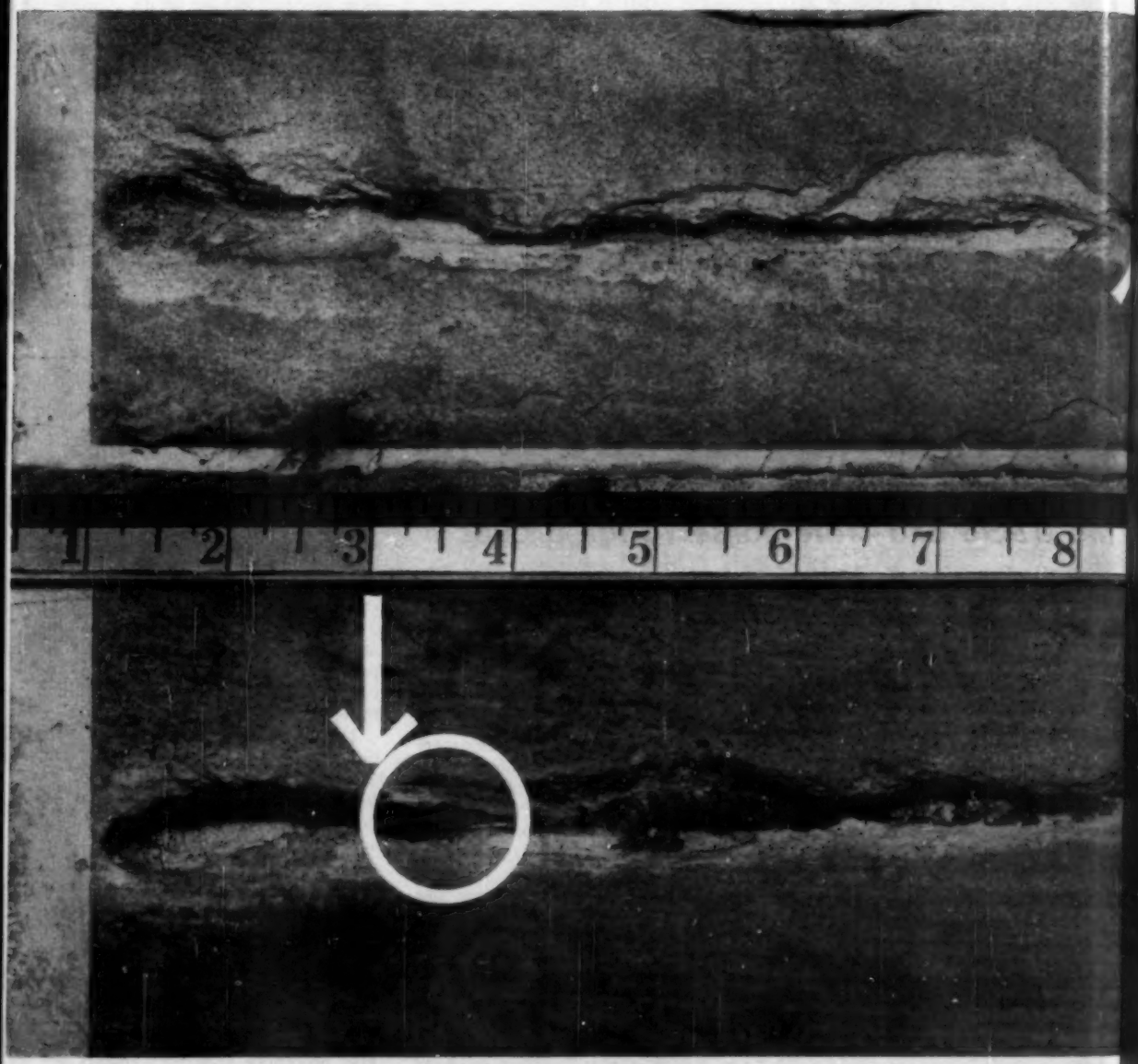
Utah: Bonding requirements are quite similar in Utah to those of New Mexico. A $5000 bond is required before drilling the first well. A state-wide bond is also available with a 25,000 acre limitation. Regulations are similar and all filings must be made to the Oil and Gas Conservation Commission, State Capitol Building, Salt Lake City.

Colorado: A plugging bond of $2500 on fee lands is required by the Oil and Gas Conservation Commission, 1162½ Elati Street, Denver. A blanket bond may be secured in the amount of $10,000. Again drilling and completion procedure and requirements are similar to those of New Mexico.

Acknowledgment

Gratitude is expressed for material used in this article to personnel of the USGS in Farmington, New Mexico, to members of the New Mexico Oil Conservation Commission staff in Aztec, to the State Land Commissioner of Arizona and to Three States Natural Gas Company and Aztec Oil and Gas Company. ★ ★ ★

HERE'S HOW THE NEW SCHLUMBERGER BIMETALLIC LINER* ELIMINATES

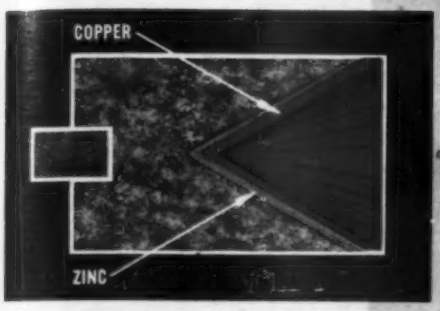


Cutaway targets of Berea sandstone into which 4" shaped charges were fired. Upper photo shows the result of the Bimetallic liner charge. Lower photo shows results of the conventional copper-liner charge. (Note large slug.) The obvious difference is that a slug is left by the copper-liner. The formation can produce, in the first target, through the full perforation of the Bimetallic charge. With the second target, the flow is limited to three inches of clean hole where the copper slug has blocked the perforation.

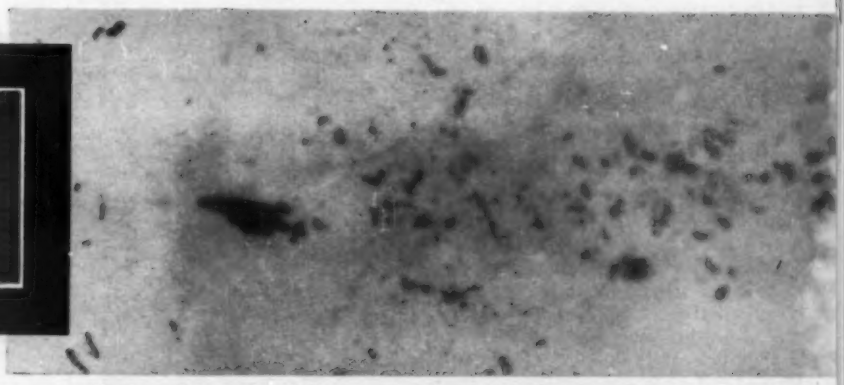
For free-flow perforations, use the Schlumberger No-Plug Bimetallic charge

SCHLUMBERGER . . . Engineering for Better Service

PLUGGED PERFORATIONS

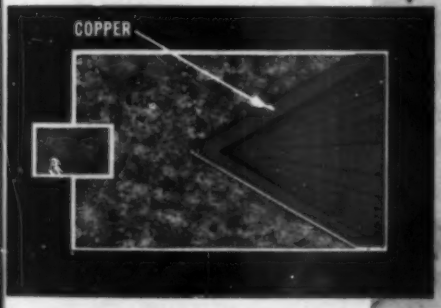


Cutaway of shaped charge incorporating Bimetallic (zinc and copper) cone liner.

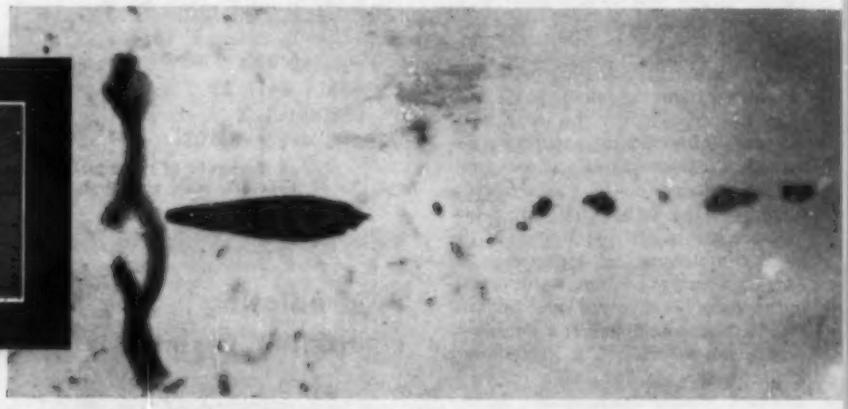


Flash radiograph of detonated Bimetallic charge. The outer portion of the liner, which ordinarily produces the copper slug, has been replaced by zinc which volatilizes.

Cutaway of shaped charge incorporating conventional copper liner.



Flash radiograph of detonated conventional charge with copper liner. (Note large size of slug.)



Since the advent of Schlumberger's flow laboratory, increased attention has been focused on new designs of shaped charges as applied to oil well completions. The fact that a real problem has existed in shaped-charge perforating cannot be denied. The problem has resulted from frequent plugging or blocking of the perforation by a "slug" or "carrot" inherently characteristic of the shaped charge.

Now, Schlumberger has developed a Bimetallic liner in which the formation of the slug is effectively eliminated in the jet process.

Tests, made under realistic conditions, prove that the slug-free perforations result in improved flow characteristics. Performance and efficiency of the individual perforations are greatly enhanced when the Bimetallic liner is used; while maintaining perforation and hole-size characteristics of the conventional copper liner.

Write for complete and detailed information on the Bimetallic liner, another great contribution in perforating from Schlumberger—the first and only service company with a perforating-flow laboratory.

*Schlumberger No-Plug Charge

Ronald Harrell
McAlester Fuel Company
Magnolia, Arkansas

In predicting remaining reserves, this . . .

NOMOGRAPH SPEEDS DECLINE CURVE ANALYSIS

Detailed calculation of remaining reserves is simplified by the construction and application of a nomograph based on decline-curve data

OF THE MANY tools available to the reservoir engineer, perhaps the decline curve ranks among the more important. No other approach so effectively integrates such unpredictable factors as seasonal fluctuations, operational down-time, and particular well problems. Although the decline curve had its greatest value before the advent of proration, it still remains useful to a great extent today in predicting the future performance of properties unaffected by curtailment or those incapable of allowable production.

Decline curves are of two general types: The logarithmic curve and the semi-logarithmic curve. The former method is predicated on the assumption that the productive history of a free-flowing well will produce a hyperbolic curve when plotted versus time on coordinate paper. Transfer of this record to log-log paper produces a straight line after the points are shifted by trial and error. Extrapolation of this relatively straight line to the economic limit provides a means of estimating remaining recoverable reserves. The above mentioned economic limit is that rate of production at which the property ceases to make a profit. This rate is dependent upon many variables, among which are geographical location, well depth, price of oil, and special well problems.

The second general type of decline curves, the semi-log curve, has gained general acceptance by the industry as a whole. Although this method tends toward underestimates when compared with the full-log plot, it is the opinion of the author that with judicious use it is as reliable a guide as the more troublesome full-log curve. No time-consuming trial-and-error shifting of points is involved, and periodic revisions are simplified. If a decline in production is evident, a straight line following this trend is simply drawn in and continued to the economic limit.

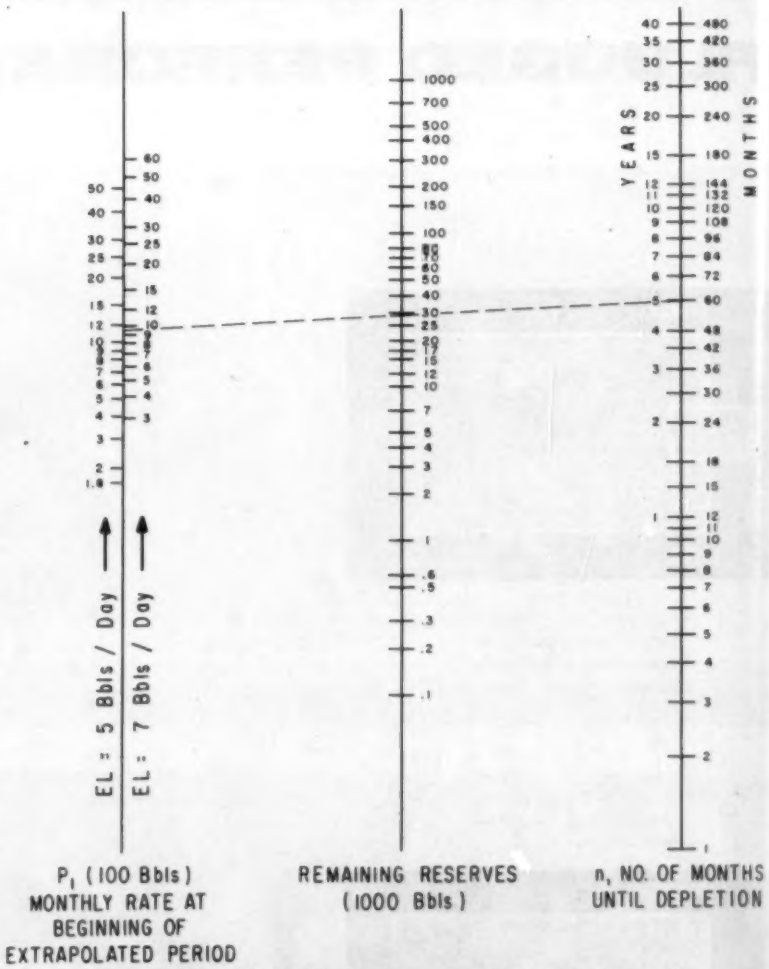

EL = 5 Bbls / Day
EL = 7 Bbls / Day
P1 (100 Bbls) MONTHLY RATE AT BEGINNING OF EXTRAPOLATED PERIOD
REMAINING RESERVES (1000 Bbls)
n, NO. OF MONTHS UNTIL DEPLETION
YEARS
MONTHS

FIG. 1. **Estimate of remaining reserves, R,** is found at the interception on the center scale of a straight line joining **P** on the left scale to **n** on the right scale.

Prediction Method

Computation of the remaining reserves for the extrapolated period may be done by several methods. If production is plotted by months as is usually the case, the estimated production for each remaining month may be determined from the curve and totaled. This method is seldom used because of the amount of time required. A second and more common method is to determine the estimated production at the midpoint of each remaining year and use that value as an average for the year. The most expedient procedure, however, is to take the monthly production

the mid-point of the entire extrapolated period and use it as the average production for the remaining life of the well or lease.

The latter two methods tend toward underestimates due to the character of the curve. The degree of error increases with the slope of the decline trend.

It is the purpose of this paper to present a simplified, yet accurate, method of determining remaining reserves through use of semi-log decline curves. For the development of the formula upon which the nomograph (Fig. 1) is based, the following nomenclature applies.

P_1 = Production at beginning of extrapolated period, bbl of oil per month,
EL = Economic limit, bbl of oil per month,
n = Time remaining to depletion (EL), months,
R = Remaining oil reserves, bbl,
r = Ratio of monthly production to that of preceding month.

Semi-log decline curves are predicted on the assumption that each month's production is less than that of the preceding month by a constant decline factor "r." This allows for use of the following expression for the sum of the geometric progression of "n" terms.

$$S_n = P_1 + P_1 r + P_1 r^2 + P_1 r^3 + P_1 r^{n-1}, \text{ and}$$

$$S_n = P_1 \frac{(1 - r^n)}{(1 - r)} \quad . \quad . \quad . \quad . \quad (1)$$

Since "n" reaches a finite value when the economic limit is reached, the following expression is true.

$$EL = P_1 r^{n-1}, \text{ or } r = (EL/P_1)^{\frac{1}{n-1}} \quad . \quad . \quad . \quad . \quad (2)$$

Substitution of "r" in Equation 2 for "r" in Equation 1 results in:

The Author

Ronald Harrell is a reservoir engineer for McAlester Fuel Company in Magnolia, Arkansas. He received a BS degree in petroleum engineering from the Louisiana Polytechnic Institute in June 1957. Prior to graduation, he had worked with McAlester Fuel Company three summers as an engineer-trainee. He is a junior member of AIME and a registered petroleum engineer in Louisiana.

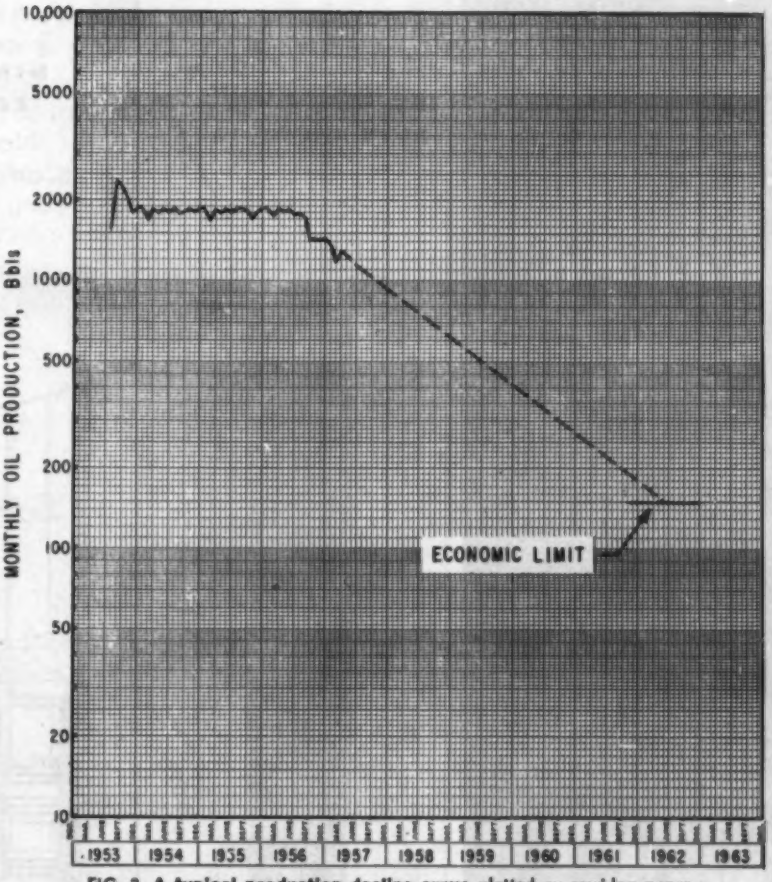


FIG. 2. A typical production decline curve plotted on semi-log paper. Production decline of a free-flowing well may be extrapolated in a straight line.

$$S_n = P_1 \left\{ \frac{1 - (EL/P)^{\frac{n}{n-1}}}{1 - (EL/P_1)^{\frac{1}{n-1}}} \right\} = R \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Simplifying the above expression for use in nomographic form involves utilizing the fact that for any given values of P and EL, the average monthly production for the extrapolated period remains constant regardless of the value of "n."

The resulting nomograph incorporates a double scale for P for two economic limits. The values of 5 and 7 bbl per day were chosen as perhaps the most common. A single line joining "P" on the left scale to "n" on the right scale intercepts "R" on the center scale.

The decline curve shown in Fig. 2 was prepared from production records of an actual well. Following about three years of allowable production, a steady decline in production occurred. Extrapolation of this trend indicates a remaining life of five years for an economic limit of five bbl per day. Examination of production records for neighboring wells in a further state of depletion substantiates this analysis.

Prediction Results

Calculation of the remaining reserves for the remaining life of the well has been done by four methods and the results are tabulated below for comparison purposes.

Method	Remaining Reserves, bbl
Mid-point of remaining life	24,300
Mid-point of each remaining year	28,750
Use of nomograph	29,500
Use of formula	29,600

It has been previously mentioned that usually any appreciable error incurred through use of semi-log decline curves results in underestimates. The above cited results indicate that the nomograph method of analysis leads to higher reserve figures. It is, therefore, the author's belief that this method should produce more accurate results.

Acknowledgment

The author wishes to extend his sincere appreciation to the management of McAlester Fuel Company for permission to publish this paper. ★ ★ ★

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PRODUCTION APPLICATIONS

SINGLE ZONE Normal Completion

SINGLE ZONE Permanent Type Well Completions

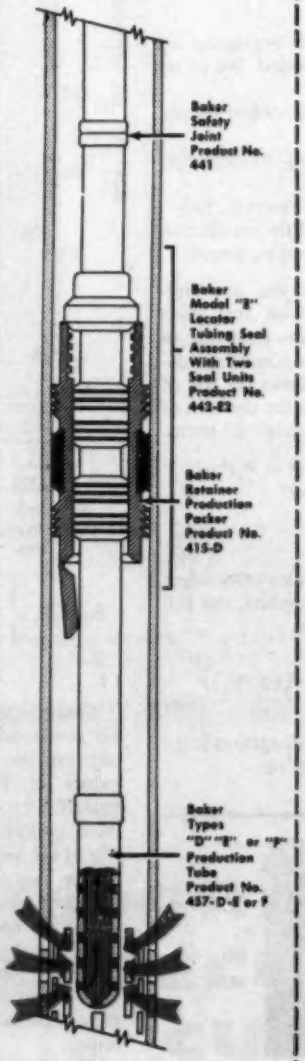
Baker Retainer Production Packer Product No. 415-D

FEATURES

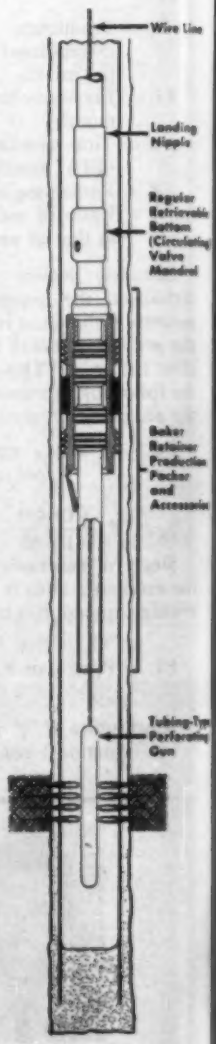
Holds any pressure from either above or below that is safe for the casing, even under temperatures in excess of 300°F.

Pack-off is independent of set-down weight or tension. Tubing string is free; just pick up (or unlatch and pick up) to remove it.

Use it as a squeeze and testing tool or as a temporary or permanent bridge plug in conjunction with any production application.

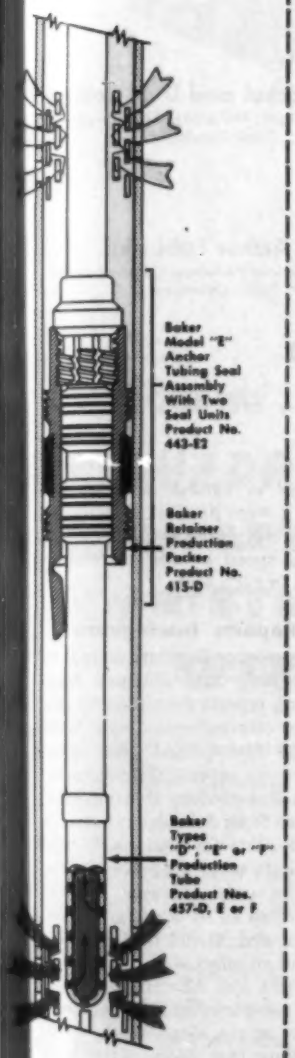

Baker Safety Joint Product No. 441
Baker Model "E" Locator Tubing Seal Assembly With Two Seal Units Product No. 442-E2
Baker Retainer Production Packer Product No. 415-D
Baker Types "D" "E" or "F" Production Tube Product No. 457-D-E or F

Illustrates Packer set in casing with Locator Tubing Seal Assembly and Production Tube installed for single-zone production.



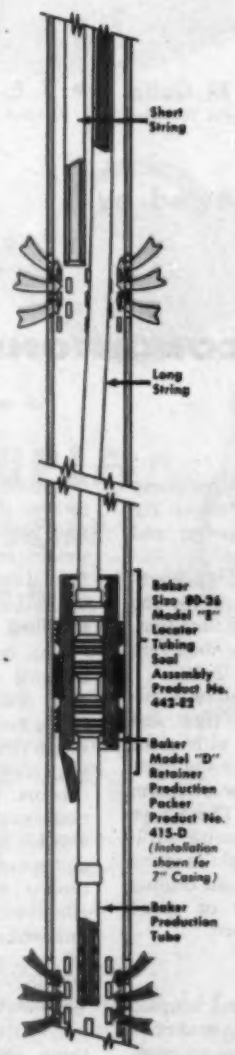
Illustrates typical Permanent-Type Well Completion Hook-Up showing perforating operation through and below the Packer.

DUAL ZONE
Normal Completion


Baker Model "E" Anchor Tubing Seal Assembly With Two Seal Units Product No. 443-E2
Baker Retainer Production Packer Product No. 415-D
Baker Types "D", "E" or "F" Production Tube Product Nos. 457-D, E or F

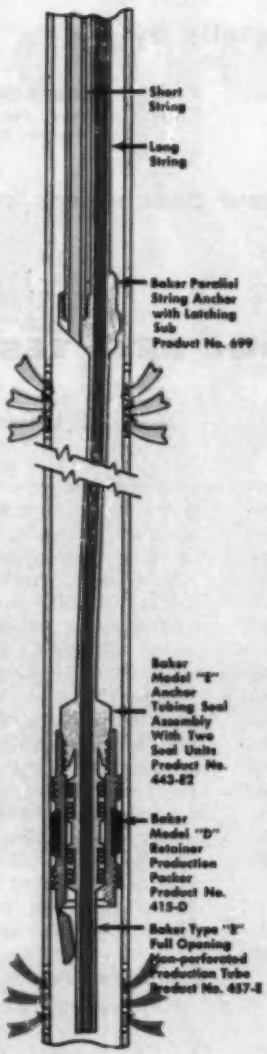
Illustrates Packer set in casing, with anchored production string for dual-zone production. Tubing can be released from Packer by rotating to right.

DUAL ZONE
Parallel String
Short String
Hanging Free


Short String
Long String
Baker Size 80-36 Model "E" Locator Tubing Seal Assembly Product No. 442-E2
Baker Model "D" Retainer Production Packer Product No. 415-D (Installation shown for 7" Casing)
Baker Production Tube

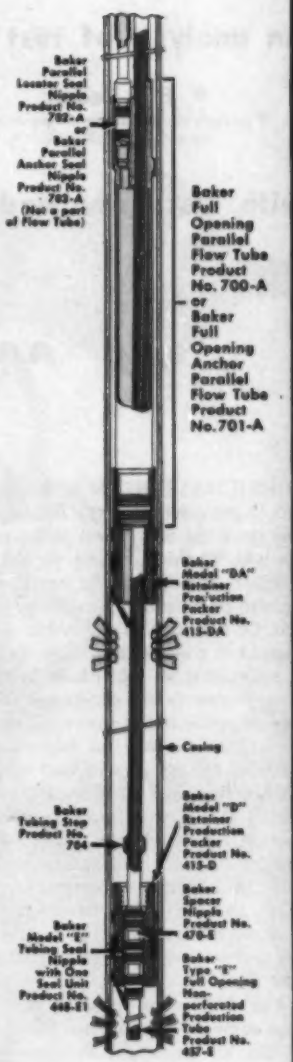
Permits removal of either string independently of the other regardless of sequence. Full-Opening (Tubing I.D.) Long String to lower zone.

DUAL ZONE
Parallel String
Short String
Anchored


Short String
Long String
Baker Parallel String Anchor with Latching Sub Product No. 699
Baker Model "E" Anchor Tubing Seal Assembly With Two Seal Units Product No. 443-E2
Baker Model "D" Retainer Production Packer Product No. 415-D
Baker Type "E" Full Opening Non-perforated Production Tube Product No. 457-E

Permits removal of either string independently of the other, however long string must be run first. Short string pulled first. Full-Opening (Tubing I.D.) Long String.

DUAL ZONE
Parallel String
Two-Packer Hook-up


Baker Parallel Locator Seal Nipple Product No. 702-A or
Baker Parallel Anchor Seal Nipple Product No. 703-A (Not a part of Flow Tube)
Baker Full Opening Parallel Flow Tube Product No. 700-A or Baker Full Opening Anchor Parallel Flow Tube Product No. 701-A
Baker Model "DA" Retainer Production Packer Product No. 415-DA
Casing
Baker Tubing Stop Product No. 704
Baker Model "D" Retainer Production Packer Product No. 415-D
Baker Spacer Nipple Product No. 470-E
Baker Model "E" Tubing Seal Nipple with One Seal Unit Product No. 448-E1
Baker Type "E" Full Opening Non-perforated Production Tube Product No. 457-E

Illustrates Two-Packer parallel string installation with each zone confined to its individual tubing string with full-opening to lower zone for use of all permanent-type completion tools.

AAODC makes first report on study of

WEIGHT / SPEED / PENETRATION

...and proposes future test methods

Contractors, oil operators, suppliers and manufacturers jointly complete initial tests in a continuing program aimed at achieving optimum drilling rates

An analysis of test results by

- **E. L. Decker**
  President, Martin-Decker Corporation
  Long Beach, California
- **H. B. Woods and E. M. Galle**
  Research Engineering Dept., Hughes Tool Co.
  Houston, Texas
- **J. E. Eckel and D. S. Rowley**
  Research Dept., The Carter Oil Company
  Tulsa, Oklahoma

with discussion and new procedures suggested by

- **Arthur Lubinski**
  Pan American Petroleum Corporation
  Tulsa, Oklahoma

AAODC SETS TEST CONDITIONS

E. L. Decker

THERE HAVE BEEN many changes and improvements in the drilling business since the conception of the rotary, but with all the advances we still have a driller standing at the brake directing and performing the drilling operation. Of course, this driller has a lot of assistance, a lot of know-how, and a lot of equipment we didn't have in the old days. Formerly rig personnel was not only responsible for most drilling functions, but selected and manufactured much of the equipment and materials employed in rotary drilling. Rig dressed fishtail bits, "poor boy" core barrels, friction type overshots, junk baskets, and, of course, rig mixed mud loaded with burlap sacks, cornhusks, navy beans and barnyard "fissure-seal" are to name but a few of the responsibilities and privileges delegated to the old-time driller.

The driller now has the help of a mud engineer to supervise the mixture of this all important fluid to proper consistency and quality that adds immeasurably to the success of the drilling program. He also has a staff of engineers in the head office to carefully plan his hydraulic program, telling him which type bit, which size nozzle, which size pump liners and what pump speeds to run in order to obtain the maximum hydraulic horsepower and therefore greater penetration.

Most functions of the drilling operation are carefully prescribed for the driller, however, two of these functions, weight and speed, if prescribed, are done so with large variable limits.

Thus, if not giving him full responsibility for the amount of weight and speed he should drill with, at least he has considerable latitude for the exercise of judgment between low minimum and high maximum limits. These have usually been established because drilling below the minimum weight or speed produced little or no hole and drilling above maximum weight or speed created havoc with equipment.

Committee Formed

It was with this fact in mind, coupled with a hope that cooperative studies of the effect of weight and speed on penetration rate, might reveal some simple, down-to-earth answers for the man whose job it is to make hole, that the Weight/Speed/Penetration Sub-Committee of the American Association of Oilwell Drilling Contractors was formed.

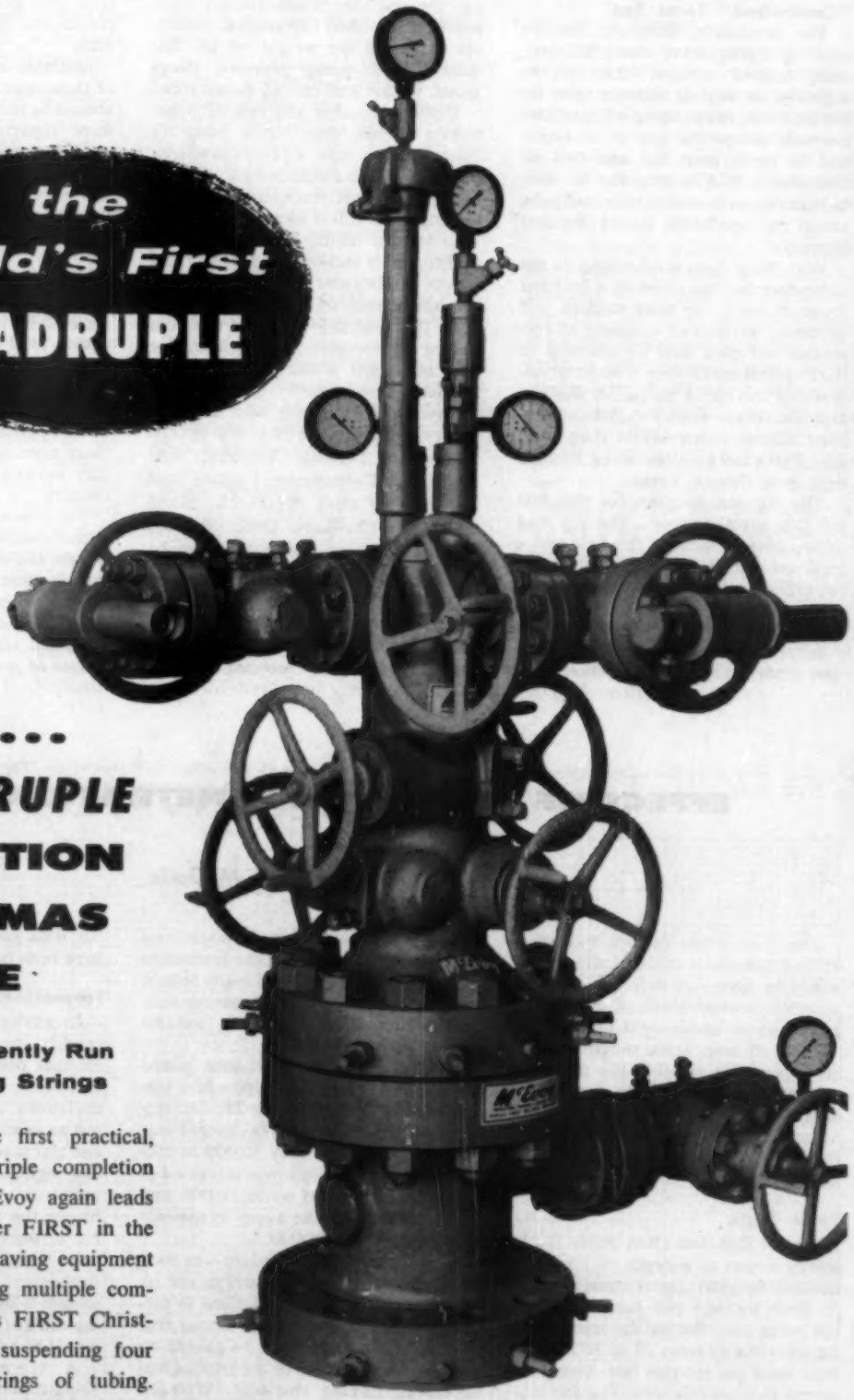
The committee was given the task of investigating normal weight and speed relationships in various areas to determine if it were possible to arrive at the most efficient combination of weight and speed to use in different formations in each area.

Drilling Reports Inadequate

The committee first attempted to evaluate drilling data obtained from daily drilling reports furnished by one of the major oil companies. Wells from which these reports had been taken were drilled by several different contractors. It was obvious that information obtained from daily drilling reports was not adequate for analysis. Weight and speed data taken from the drilling reports were only averages at best. However, when all of the reports from one well showed 30,000 lb weight and 30 rpm, and an offset well showed 45,000 lb weight and 35 rpm, and both wells were completed in the same number of days at the same depth, it became obvious that there must have been other factors affecting the drilling rate in order to balance out the differences in weight and speed carried on the two wells. There also must have been variations in weight and speed on each well as it is known that actual bit weight and rotary speed may vary as much or more than 50 percent of the reported average.

Presented as a report of the Weight/Speed/Penetration Sub-Committee at the seventeenth annual convention of the American Association of Oilwell Drilling Contractors in Tulsa, Oklahoma, October 13-15, 1957.

the World's First QUADRUPLE



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"Controlled" Tests Set

The committee, therefore, decided to set up a program of controlled tests, using trained engineer observers to supervise as well as observe each individual test, maintaining all functions constant except the one to be varied and to verify each test and that all functions should be recorded in order to better observe and to later study the actual rig operations during the test interval.

With these facts confronting us the committee decided to set up a field test program using the most modern and advanced methods of recording and reporting test data. Ben Groenewold of the Exploration Drilling Company volunteered the use of his rig for this test and The Texas Gulf Producing Company offered a test site at their well, Roy Parks B-23, in the Dora Roberts field, near Odessa, Texas.

The rig and location for this test was an excellent one. The rig had drilled over 20 wells in this field and a great amount of geological and practical drilling information was available.

Testing Instrumentation

In order to better observe and to later study the actual rig functions during the test the Martin-Decker Corporation furnished two electric recorders to record the weight on the bit, rotary speed, pump pressure, pump speed, torque and rate of penetration.

Drilling function and rate of penetration signals were taken from rig floor instruments and transmitted through electric conductor cable to the multiple channel recorders located in the doghouse 150 ft away from the rig. Also located in the doghouse were a drafting table and other equipment and files of drilling and geological data for the convenience of engineer observers.

At this remote location an excellent record of complete rig performance was assembled, studied and prepared for later evaluation by the full committee. On hand during each test were one or two engineers furnished by The Exploration Drilling Company; Martin-Decker Corporation; Hughes Tool Company; Carter Research; Reed Roller Bit Company; Great Western Drilling Company, and Oil Well Supply.

These men supervised the procedure and sequence of tests by closely studying the expected geological formation. They also served as observers of the tests, and from the recorded information, prepared data sheets giving the results and their opinion of these results.

Methods employed and the results of these tests are presented here; but it should be noted that all of the tests run were reported — even though some were obviously affected by mechanical or formation effects. The data sheets and copy of the recorded charts were then sent to all members of the committee for their study and evaluation.

107 Tests Run

Two series of tests were run on separate wells in the Dora Roberts field with a total of 107 tests run. A committee meeting was held at the end of each well to discuss the results and to determine future action.

It is planned to run one or two more tests in the West Texas area before moving on to other parts of the country.

The committee's final objective is the determination of the most economical weight and speed to carry in each particular zone, in each particular area of the country, but our immediate aim is to arrive at the basic relationship of increased weight and increased speed to rate of penetration.

EFFECT OF WEIGHT ON PENETRATION RATE

H. B. Woods and E. M. Galle

There are many factors that affect drilling rate and a study of all of them would be necessary before making an accurate determination of the drilling procedure for obtaining the lowest cost per foot of hole. Since weight and rotary speed are possibly the most important of these factors, the immediate efforts of this committee are directed toward determining the relationship between weight, rotary speed and penetration rate.

Basic Tests

On the first well (Roy Parks B-23) testing began at a depth of 10,190 ft and continued to approximately 13,000 ft. Both toothed and carbide-studded bits were used during the tests. Drilling intervals of from 20 to 30 minutes were used for toothed bits during the weight tests on this well. The test procedure consisted of beginning at a weight of 20,000 lb and increasing in 5000 lb increments to 50,000 lb, then running a check interval at 20,000 lb to determine how much the formation had changed. Sometimes it appeared that this procedure indicated something about the uniformity of the formation being drilled, however, in many tests it was apparent that the formation may have changed considerably several times during one test.

As a result of the experience gained on the first well, the test procedure was revised on Roy Parks B-25. On this well, the range of weights covered was reduced to include only 30,000 to 50,000 lb, and the weight was increased in 5000 lb increments up to 50,000 and then reduced by the same increments back down to 30,000 lb.

Purpose of this procedure was twofold. First, it was to average out as much as possible the variations in formation and second, it was hoped that some information could be gained on the degree of dulling of the bit that had occurred during the test. Without doubt, the procedure on the second well was better than that used on the first; however, even this procedure left much to be desired. Test procedures for the carbide-studded bits were very similar to those used for toothed bits. All data concerning the weight tests have been tabulated.

Formations Vary Results

In analyzing these data, it became readily apparent that formation changes occurred many times during individual tests and that formation drillability changed greatly from one test to another. Since the scatter in any one test was so great that it prevented any significant interpretation, it was necessary to find some manner of combining the results from a large number of tests to average out the formation variable. Since the formation drillability changed greatly from test to test, a direct averaging of the drilling rates of all tests at a specific weight would be meaningless.

A very convenient manner of averaging the data where drilling rates vary appreciably from one test to another is through the use of relative drilling rates and all remaining figures are plots of relative drilling rate versus weight.

We will not explain the details of the method; however, the results obtained

ve a ratio of relative drilling rates for y two weights that will be the same the ratio of the actual drilling rates those weights.

All the data from each well were eraged and the results from the two ells were almost identical.

Overall averages of the effect of eight showed approximately a straight ine relationship between weight and illing rate, with a slope such that within the range of weights investigated a 50 percent increase in weight will give about a 65 percent increase in drilling rate (Fig. 1). Actually, the approximate slope of the line in the normal range of operating weights is of much greater significance than whether it is straight or not, since the slope of the line determines the amount of advantage to be gained by increasing weight. The relation between weight and penetration rate at very low weights was not investigated. Since the exact shape of the weight versus drilling rate curve is not known in the lower weight region, the results of the data obtained, within the limits of these tests, could be approximated with a power curve of:

$$\text{Relative Drilling Rate} = K\,(\text{Weight})^n,$$

where K is a constant and n is approximately 1.2.

On Roy Parks B-23, the relationship between weight and drilling rate for carbide-studded bits was similar to that for toothed bits (Fig. 2). Tests with carbide-studded bits on Roy Parks B-25 showed less increase in drilling rate with increased weight than was noted for the toothed bits.

Bit hydraulic horsepower was very low during the time that the carbide-studded type bits were run on this well, and perhaps the results obtained may have been greatly influenced by that factor.

Due to formation drillability changing so often during an individual test, a study of the variations in the effect of weight on drilling rate from one formation to another could not be made.

Major Problems

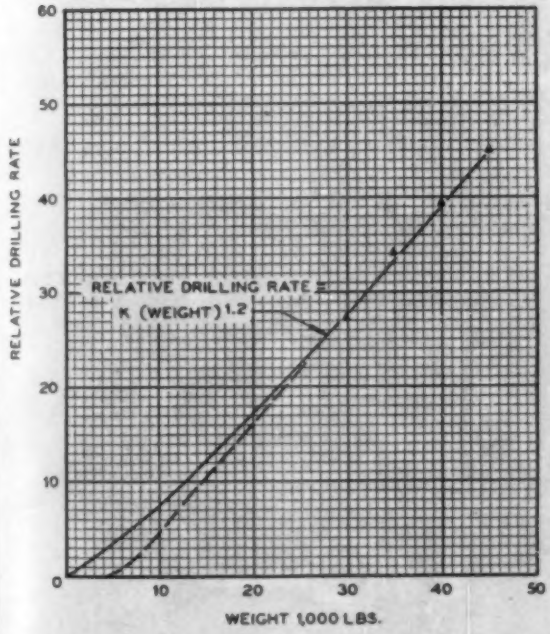
The major problem encountered was formation variables, as is generally the case in tests of this nature. Other difficulties such as accurate timing of intervals, dulling of the bit, maintaining constant rotary speed, pump strokes, and bit load were encountered, however, these were minor in comparison with the formation variables.

What to Expect

Future tests should enable the committee to refine the results obtained thus far and extend the range of weights investigated. Testing in other parts of the country should provide a basis for determining if the weight versus drilling rate relationship is substantially the same for different areas and formations.

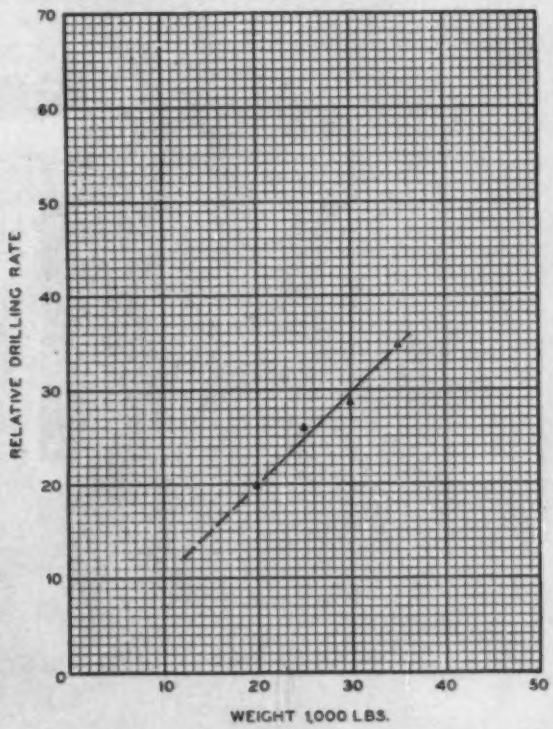
Variations in a formation's drillability is something that cannot usually be foreseen, and any test procedure should take this fact into consideration. Present plans for any further testing of the relation between weight and penetration rate are to select only two weights whose magnitudes are such that the change in drilling rate obained by alternating the weights will be greater than the normal scatter at a given weight. It is felt that this procedure will be a big improvement over past procedures used with respect to eliminating formation variables and effect of bit dulling. With further testing and improved test techniques, we hope to be able to determine the relation between weight and drilling rate for a given formation.

FIG. 1. **Effect of weight on penetration rate.** Roy Parks B-23 and B-25, toothed bits. Tests: (B-23) 1, 3-8, 43-46. (B-25) 1-7, 9, 13-15, 17, 18, 22-24, 26-28, 32, 45, 46, 49, 51-53, 55, combined data.



Straight line relationship is shown between weight and drilling rate, with a 50 percent increase in weight yielding a 65 percent increase in drilling rate.

FIG. 2. **Effect of weight on penetration rate.** Roy Parks B-23, carbide-studded bits. Tests 17-19, 24-26, 30-32, bit HHP-135 to 235, averaged data.



On the first well drilled, weight and drilling rate relationship for both toothed bits and carbide-studded bits were similar.

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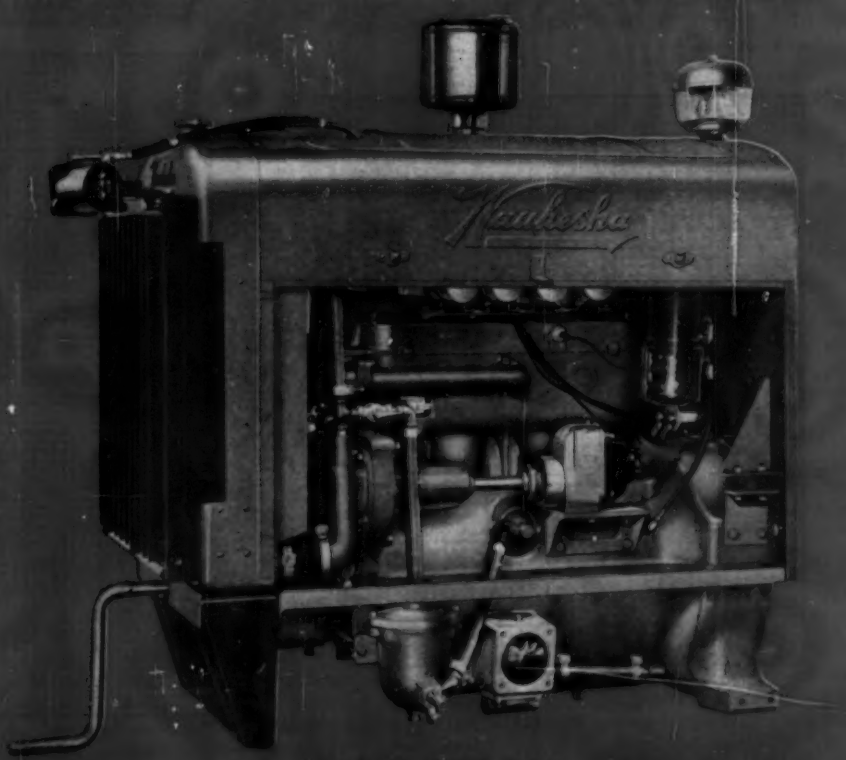

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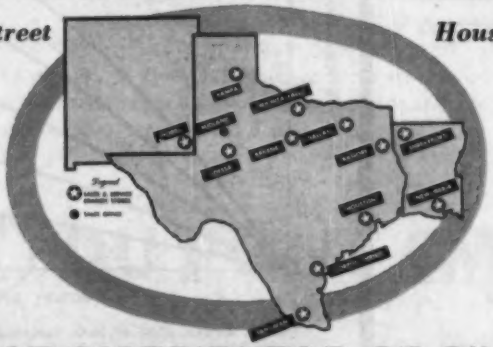

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EFFECT OF SPEED ON PENETRATION RATE

J. E. Eckel and D. S. Rowley

In the West Texas AAODC tests, the WSP Committee had as its goal an experimental investigation of the effects of weight and speed on drilling rate. The objective of this particular section of this report is to present the results of the rotary speed versus penetration rate experiments. Factors found to be disturbing results will be discussed, as well as some suggestions which may help to improve the eventual reliability of the results.

Basic Procedure

Of the 107 separate tests run on the two wells, Roy Parks B-23 and B-25, 36 were run with the weight and all other functions held constant. Rotary speed was the only variable.

In general, for both carbide-studded bits and conventional milled toothed bits, a pre-selected interval of time or footage was drilled at each speed in the tests. Rotary speed was generally increased in increments of 5 or 10 rpm from a minimum speed to the maximum in the test. Then in certain cases, speed was reduced to the minimum in similar increments. This procedure was intended to help average out the drilling rate effects of local formation changes and to minimize the effects of bit dulling.

Fig. 3 shows two plots of drilling rate data from rotary speed Test No. 9 on Parks B-23 and Test No. 21 on Parks B-25. The considerable difference evident between drilling rates at equal speeds in both these tests is attributable mainly to localized changes in formation drillability occuring during the test.

On both wells, rotary speed tests were made at constant bit weights.

The bit weights used, however, varied from test to test in the range 20,000 lb to 50,000 lb. The range of rotary speeds was from 20 to 50 with carbide-studded bits and 30 to 115 with milled tooth bits.

Results

Analysis of all available weight and speed data together showed that local formation changes in the test intervals radically influenced the results of any one given test. For instance, Fig. 4 shows drilling rate plotted against depth for a test made at constant speed, constant weight and with a constant circulation rate. Drilling rate in this particular test varied about 50 percent, from maximum to minimum, presumably as a result of local formation effects.

Although this example is not necessarily an average situation, there was enough scatter of data in any of the tests to indicate the need for averaging a large number of data points in order to arrive at any concrete results.

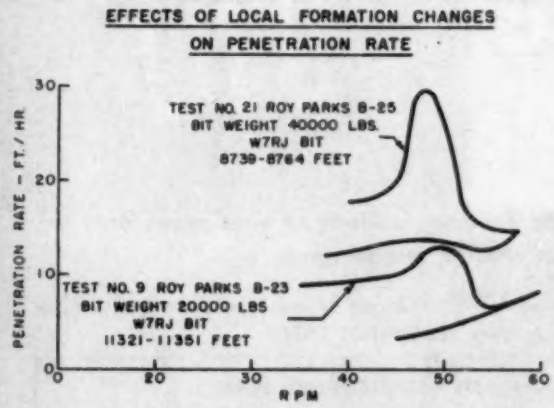


FIG. 3. **Formation changes** make noticeable changes on penetration rate.

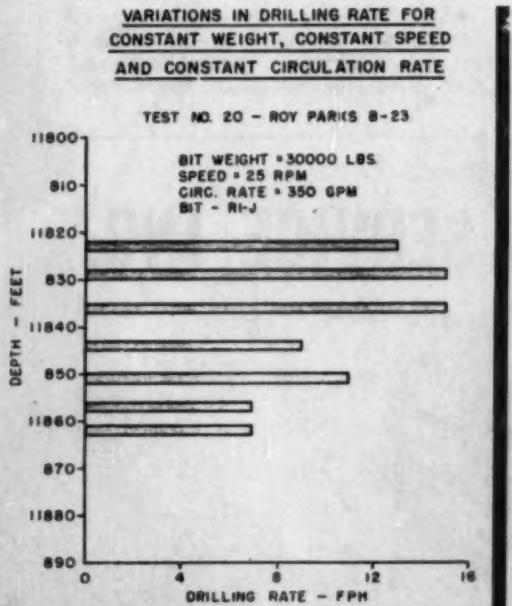


FIG. 4. **Variations in drilling rate** were noted where weight, speed and circulation rates were held constant.

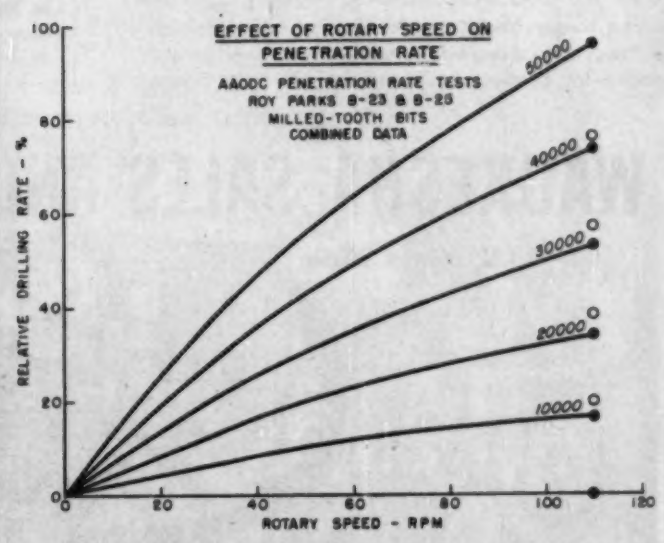
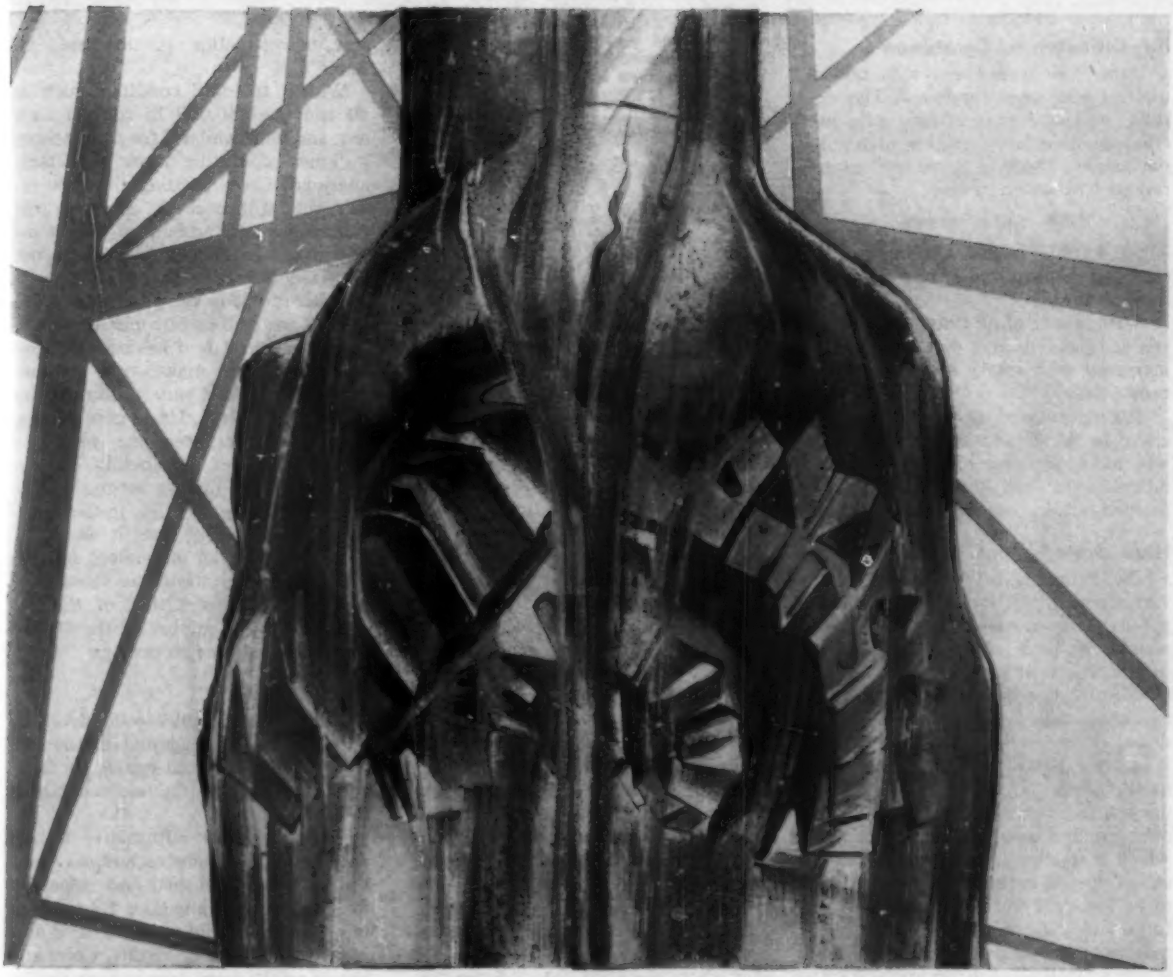


FIG. 5. **Cross plot** of both variable speed and variable weight revealed slight disagreements, as shown in dots at rotary speed of 110 rpm. Solid dots indicate results and open circles indicate variables for agreement.



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Bit Differences Combined

Data from tests taken with milled toothed bits were combined. The results, indicated that drilling rate increased with rotary speed less than proportionally. This type curve can be represented by an equation:

$$RDR = a + bn + cn^2$$

where RDR is relative drilling rate; n the rotary speed; and a, b, c are arbitrary constants.

A composite of all tests for carbide-studded bits indicated that drilling rate increased with rotary speed less than proportionally.

The tendency of the penetration rate curve to flatten out at higher speeds was more pronounced with the carbide-studded bits than with milled toothed bits.

High Speeds Not So Effective

The flattening of the rotary speed versus penetration rate curve at higher speeds seems to indicate that when bit weight is held constant, individual tooth contacts at higher speeds are not as effective in removing the formation as contacts at lower speeds. The reduced effectiveness of high speed contacts may be an effect of time. The tooth delivers an impulse — the product of a force and the time interval over which it acts — to the formation which is smaller at higher speeds than at low speeds, assuming the bit weight to be the same in both cases. Thus, if future tests substantiate the flattening trend of the rotary curve (and certainly we will need many more tests), it may be possible to conclude that the low rotary speeds permit the bit teeth to use available weight to the best advantage. It does not appear likely that the flattening of the speed curve can be attributed to cleaning effects, since high circulation rates in the range of 370 to 440 gal per min were maintained for the 7⅞-in. hole experiment.

TABLE 1. Speed Tests. Standard Condition Is Assumed as 40 rpm, 30,000 lb.

Sample Test

Speed	*Weight*
40	30,000
20	20,000
40	20,000
60	20,000
80	20,000
100	20,000
40	30,000

Problems

Although there have been many improvements in the basic test procedure since the first tests were run on Parks B-23, there are still indications of the need for further improvement. At the same time, it is also true that strict techniques cannot always be attempted when the contractor is trying to make hole, so various compromises must be made in the test procedure to facilitate drilling progress.

One indication of a needed change in test procedure is brought out by attempting to cross-plot the results of both the variable speed and variable weight tests. Even when all the data are analyzed by exactly the same methods, a slight disagreement in results is found. In Fig. 5, this is shown at 110 rpm where the solid dots indicate "results" and open circles indicate "required for agreement."

One test procedure that might correct this situation is illustrated in Table 1.

With a standard condition such as 40 rpm and 30,000 lb run on each test, and then available for comparison, the data could be more accurately analyzed. Cross plotting the new results should then check, assuming that a sufficient total amount of data is accumulated to effectively average out localized formation effects.

Other problems concern rotary speed control and drilling rate measurements. In the tests to date it has been difficult mechanically to maintain a constant rotary speed and vary it through an established pattern. Up to now this appears to have been the result of slight difficulties in holding the required throttle linkage setting on the rotary drive engine. Also, in the measurement of drilling rate, it would be helpful to have an instrument capable of measuring short intervals accurately, thus relieving the driller of this responsibility and improving the quality of penetration rate recordings.

Future Tests

Additional variable speed data obtained with the suggested revision in test procedure should enable the subcommittee to refine the results obtained to date.

Once the most informative testing and data processing techniques have been firmly established and subjected to a thorough evaluation, future tests in new areas should permit a rapid and reliable extension of results. Comparison of results from area to area should also aid in establishing limits of speed within which the indicated trends are valid for different local conditions.

A FRUITFUL BEGINNING

E. L. Decker

The sub-committee is unanimous in its desire to make certain that it be fully understood that this report is a preliminary report and the results today reflect only the trends of a relatively few tests.

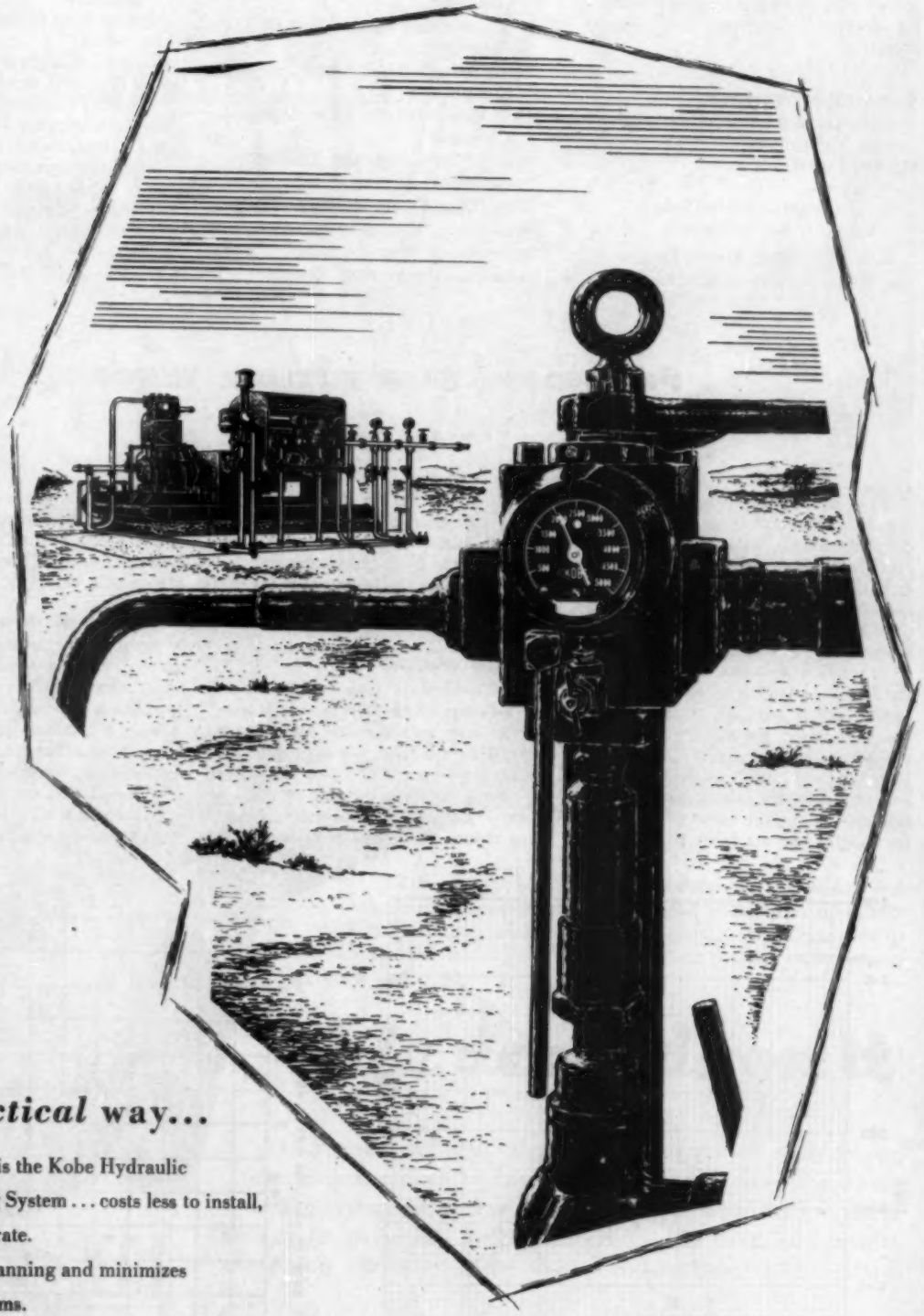
There have been many lab and field tests investigating the effects of weight and speed, but the association should take some pride in noting that one of its committees is using some equipment and testing procedure that was not available or used in past tests. This is the first time the recording of all the rig functions could be placed in a remote location for better study and reproduced in a clean, complete, extremely accurate, form. Also, these tests include recordings of rotary and pump speeds, which, in the past, were never too successful.

A Joint Effort

There is another aspect to the committee's work that should also be pointed out. These recordings of actual tests and the data sheets compiled by the engineers observing the tests were sent to all committee members for their study and evaluation, at their convenience and with a certain amount of help from their associates. Fifteen men from three different states, all experienced and well qualified, studied these reports, drew up their own graphs and results, and at our committee meetings each man presented his own opinion in his own way.

This isn't a one-man committee, and its results are not the ideas of a single company or a single personality. When we do finally arrive at more definite decisions as to the effect of weight and speed, the records will still be available for anyone who wishes to question our results. An observer is fine, but we're making a complete record.

The Association should also take note to another enlightening and interesting fact. The two tests to date and the several tests planned in the future are being undertaken on a contractors rig; drilling for an operating company; with special equipment furnished by



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Committee Workers

Members of the Weight/Speed/Penetration Sub-Committee of The Rotary Drilling Committee are:

E. L. Decker, Martin-Decker Corporation, chairman

J. W. Knowlton, Martin-Decker Corporation, vice chairman

Lewis Andrews, Exploration Drilling Company

R. G. Brandes, Reed Roller Bit Company

H. G. Bentson, H. C. Smith Company

D. E. Broussard, Shell Development Company

Sam T. Crews, Brantley Drilling Company

J. E. Eckel, Carter Research

Paul Green, Hughes Tool Company

John Pedigo, Texas A & M

Alex Quayle, Oil Well Supply

Henry Woods, Hughes Tool Company

Also assisting in the tests and committee work:

Philip C. Blackburn, AAODC

Ray Brommel, Great Western Drilling Company

Ed Galle, Hughes Tool Company

B. C. Groenewold, Exploration Drilling Company

B. E. Groenewold, Exploration Drilling Company

Dave Rowley, Carter Research

Jack Seifreit, Oil Well Supply

Joe Tipton, Oil Well Supply

PROPOSAL FOR FUTURE TESTS

Arthur Lubinski

Work of the Weight/Speed/Penetration Study Committee should be highly commended. To conduct such a study one must have a real patience and determination, and all the members of the committee have shown that they have both these qualities to a high degree.

The difficulty of the task resides in the fact that drilling characteristics of formations are generally changing from layer to layer. Rarely are the same characteristics encountered in successive 2-ft intervals. And to obtain the rate versus weight law in some formation for a constant value of rpm and for weights varying from 30,000 lb to 50,000 lb by 5000-lb increments, the formation characteristics should remain the same over an interval of 12 ft (including the last interval run with the same weight as the first one). This explains the enormous scatter of results reported by Woods.

Revised Method

The method he proposes to use in the future is appreciably better. It consists of carrying alternately two weights only. This will require a homogeneous section of 6 instead of 12 ft. With care one could measure the rate of drilling over 1 instead of 2-ft intervals and thus reduce the above-mentioned 6 ft to 3 ft. But even the results of such a method are bound to present a great scatter, and a very large number of measurements will be needed to arrive statistically at significant results.

Proposed Method

Purpose of this discussion is to propose a method which should permit determination of an entire rate versus weight curve over a very short interval, generally of a few inches. The method consists of either recording, or reading and plotting, weight versus time during drilling-off periods. Fig. 6 shows such a hypothetical plot. In order to correct for experimental errors, a smooth curve

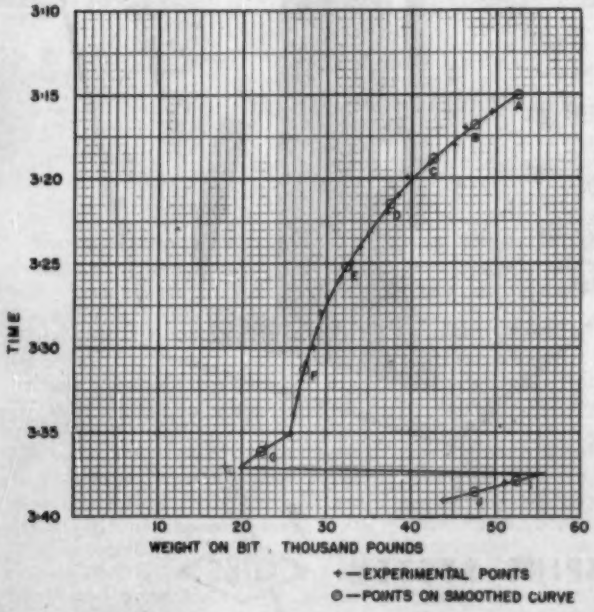

FIG. 6. **Record** during drilling off.

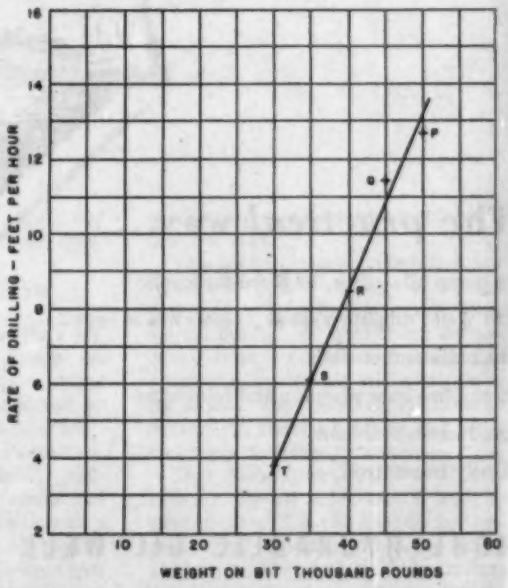

FIG. 7. **Rate vs weight** curve corresponding to interval A-F in Fig. 6.

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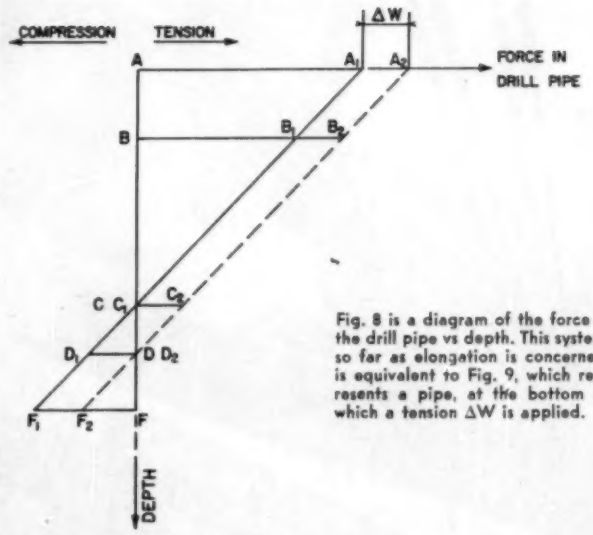

Fig. 8 is a diagram of the force in the drill pipe vs depth. This system, so far as elongation is concerned, is equivalent to Fig. 9, which represents a pipe, at the bottom of which a tension ΔW is applied.

FIG. 8.

FIG. 9

is drawn through experimental points.

Consider now points A and B located on the smoothed curve and corresponding to weights on bit of 52,500 and 47,500 lb respectively. The time interval between A and B is 1.8 minutes. Thus, the rate R_w with which the weight is dropping is equal to:

$$R_w = \frac{52{,}500 - 47{,}500}{1.8} = 2777 \frac{\text{lb}}{\text{min}} = 166{,}600 \frac{\text{lb}}{\text{hr}}$$

As proved in the Appendix, the relationship between R_w and the rate of penetration R_p is as follows:

$$R_p = L \times \frac{1}{EA} \times R_w \quad . . \quad (1)$$

in which

R_p is the rate of penetration, ft per hr

R_w is the rate with which the weight on the bit is decreasing, lb per hr

E is the Young modulus of steel: $E = 30 \times 10^6$ psi

A is the cross-sectional area of drillpipe wall, sq in.

and L is the length of drill pipe, ft

For 4½-in. – 16.6 lb per ft drill pipe, A is equal to 4.407 sq in. Consider that the results of Fig. 6 were obtained with a length of drill pipe equal to about 10,000 ft. Then Equation 1 becomes:

$$R_p = 76 \times 10^{-6} R_w \quad . . . . . \quad (2)$$

Thus, for the interval AB the rate of drilling is:

$$R_p = 76 \times 10^{-6} \times 166{,}600 = 12.7 \text{ ft per hr}$$

which corresponds to an average weight on bit of 0.5 (52,500 + 47,500) = 50,000 lb.

In Fig. 7 is plotted the rate versus weight. Point P (50,000 lb, 12.7 ft per hr) represents the result so far obtained from the hypothetical record, Fig 6. Repeating the same calculations for intervals BC, CD, DE, and EF, the rates of penetration in the investigated formation for weights on bit of 45,000, 40,000, 35,000 and 30,000 lb are obtained and plotted in Fig. 7 at Q, R, S, and T.

Each value of the rate of penetration is thus measured over a very short depth interval ΔL which, as shown in the Appendix, may be calculated as follows:

$$\Delta L = L \times \frac{1}{EA} \times \Delta W \quad . . \quad (3)$$

in which ΔW is the drop of weight in lb in the depth interval ΔL in ft. For 4½ in. – 16 lb per ft drill pipe and a 10,000-ft length of drill pipe, Equation 3 becomes:

$$\Delta L = 76 \times 10^{-6} \Delta W \quad . . . \quad (4)$$

Thus, for intervals ΔW of 5000 lb, we obtain:

$$\Delta L = 76 \times 10^{-6} \times 5000 = 0.38 \text{ ft} = 4.56 \text{ in.}$$

ΔL would even be smaller at depths shallower than 10,000 ft used in the example.

Proposal Advantages

From the above it is seen that in the proposed method the rate of drilling is measured over very short depth intervals, thus greatly increasing the probability that formation characteristics will remain constant. Therefore, the number of experiments could be much smaller than with the presently used technique. Results should be obtained faster and at less expenditure.

Another advantage of the proposed method is that changes in formation characteristics are seen in the record. For instance, in the hypothetical record, Fig. 6, a much softer formation was encountered at 3:35, i.e. between points F and G. Thus, one may reject from consideration intervals, such as FG, containing a formation change. After such a change, one may immediately use the intervals which follow, such as IJ, to investigate the rate-versus-weight law in the newly encountered formation.

Appendix

Fig. 8 is a diagram of force in the drill pipe versus depth. AA_1 represents the tension in the string at the surface, BB_1, the tension at depth B, etc. The neutral point is at C. At the depth D, the string is under compression DD_1. Finally at the lower end of drill pipe the compression is FF_1.

For the sake of simplicity, no drill collars are considered, the conclusion which will be reached being independent of the presence of collars. Consider now that a weight ΔW has been drilled off. The corresponding situation is indicated with a dashed line. The tension at the surface is now AA_2 (A_1A_2 representing ΔW), the tension at the depth B increased from BB_1 to BB_2. At C, zero tension increased to a tension CC_2. At D the compression DD_1 became nil. And finally at F the compression FF_1 decreased to the value FF_2. From inspection of Fig. 8, it is seen that at any point, either the tension increased by ΔW, or the compression decreased by the same amount ΔW, or the compression became tension, the total change being again ΔW. An increase of tension has the same effect on elongation as an equal decrease of compression. Therefore, as far as elongation is concerned, the system of Fig. 8 is equivalent to that of Fig. 9, which represents a pipe, at the bottom of which a tension ΔW is applied. The corresponding elongation ΔL, obtained from Hooke's law is Equation 3, previously considered.

Taking the derivative with respect to time of ΔL and ΔW in Equation 3, Equation 1, previously considered, is obtained. ★ ★ ★

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World-Wide Geophysical Activity Sets New Record in 1956

Eastern Hemisphere leads the world in increased activity over 1955

A NEW HIGH RECORD in world-wide geophysical activity by the petroleum industry was reached in 1956. Increased activity during the second half of the year was more than enough to offset the slight downward trend which was indicated at midyear. An average of 1136 geophysical crews of all types was employed during the year, while in 1955, the average was 1119 crews. Geophysics explorations were reduced below the 1955 level in the major areas of the Western Hemisphere. In the Eastern Hemisphere significant increases occurred in spite of political disturbances which caused interference with the work in parts of North Africa and the Middle East.

World-wide distribution of geophysical activities by area and by method are shown in Table 1. Exploration by the seismic method showed a slight increase, 0.6 percent, in 1956 as compared to the previous year. Gravity work increased 8.4 percent and magnetic work declined 8.2 percent. Explorations by other methods, mainly electrical, declined 12.0 percent and accounted for a very small portion of the total effort.

In the United States declines were reported in the use of all geophysical methods. Total effort in the U. S. was down 4.6 percent in 1956; explorations in Canada declined 5.4 percent, and activity in the entire Western Hemisphere was down 3.7 percent.

Condensation of the Report of the Committee on Geophysical Activity of the Society of Exploration Geophysicists, Homer G. Patrick, chairman.

Fig. 1 shows the world distribution of seismograph prospecting during 1956. Percentage figures in the divisions of the chart represent percent of the world's total seismic work. The (+) and (—) signs in this chart, as well as in the charts to follow indicate increases or decreases in relative concentration of activity in 1956 as compared to the year 1955. The Western Hemisphere with 82.1 percent of the world's total seismic work and particularly North America, accounting for 76.4 percent of the total effort, continues to dominate the chart.

Although its percentage participation in the global effort has been decreasing the past few years due to increased activity in other parts of the world, the United States still accounts for the major portion of the seismic exploration work. Use of the seismograph in the Eastern Hemisphere increased from 14.5 percent of the total world effort in 1955 to 17.9 percent in 1956.

World distribution of gravimetric operations during 1956 is shown in Fig. 2. Decline in the utilization of the gravity method in the Western Hemisphere, coupled with stepped up use of the method in major areas of the Eastern Hemisphere, resulted in reduction of the Western Hemisphere's participation in the world's total gravity effort from 69.7 percent in 1955 to 61.7 percent in 1956. Decrease in gravity exploration work in the Western Hemisphere occurred wholly within the United States and Canada. Actually, decline measured in crew-months was small. Significant percentage increases in gravity exploration occurred in Africa, the Middle East, and the Far East.

Eastern Hemisphere

Europe. Germany, France, and Italy, following the pattern of 1955, were the scenes of greatest concentration of geophysical effort in Europe during 1956. The three countries combined accounted for more than 80 percent of the total European effort. In Germany and France there were substantial increases in seismic explorations. In-

TABLE 1. Crew-Months of Geophysical Exploration for Petroleum.

	U.S.A.		Canada		Western Hemisphere		Eastern Hemisphere		World		
	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956	Percent change
Seismic	7,090	6,813	1,496	1,423	9,395	9,062	1,589	1,983	10,984	11,045	+ 0.6
Gravity	1,074	998	103	88	1,431	1,369	621	855	2,052	2,224	+ 8.4
Magnetic	76	45	—	1	146	127	173	166	319	293	— 8.2
Other	—	1	—	—	15	18	60	48	75	66	—12.0
Total	8,240	7,857	1,599	1,512	10,987	10,576	2,443	3,052	13,430	13,628	+ 1.5

Cardwell Model M250 Travelrig

Heavy-duty, self-propelled "drive-in" for servicing and workover to 13,000 ft., pulling 2½" tubing. Drills to 10,000 ft., using 2⅞" drill tubing, as a deep slim hole rig. Built-in draw works features large brakes and large drums for three-wrap spooling. Unit has high maneuverability and a short turning radius — with width and height well within legal limits of most states.

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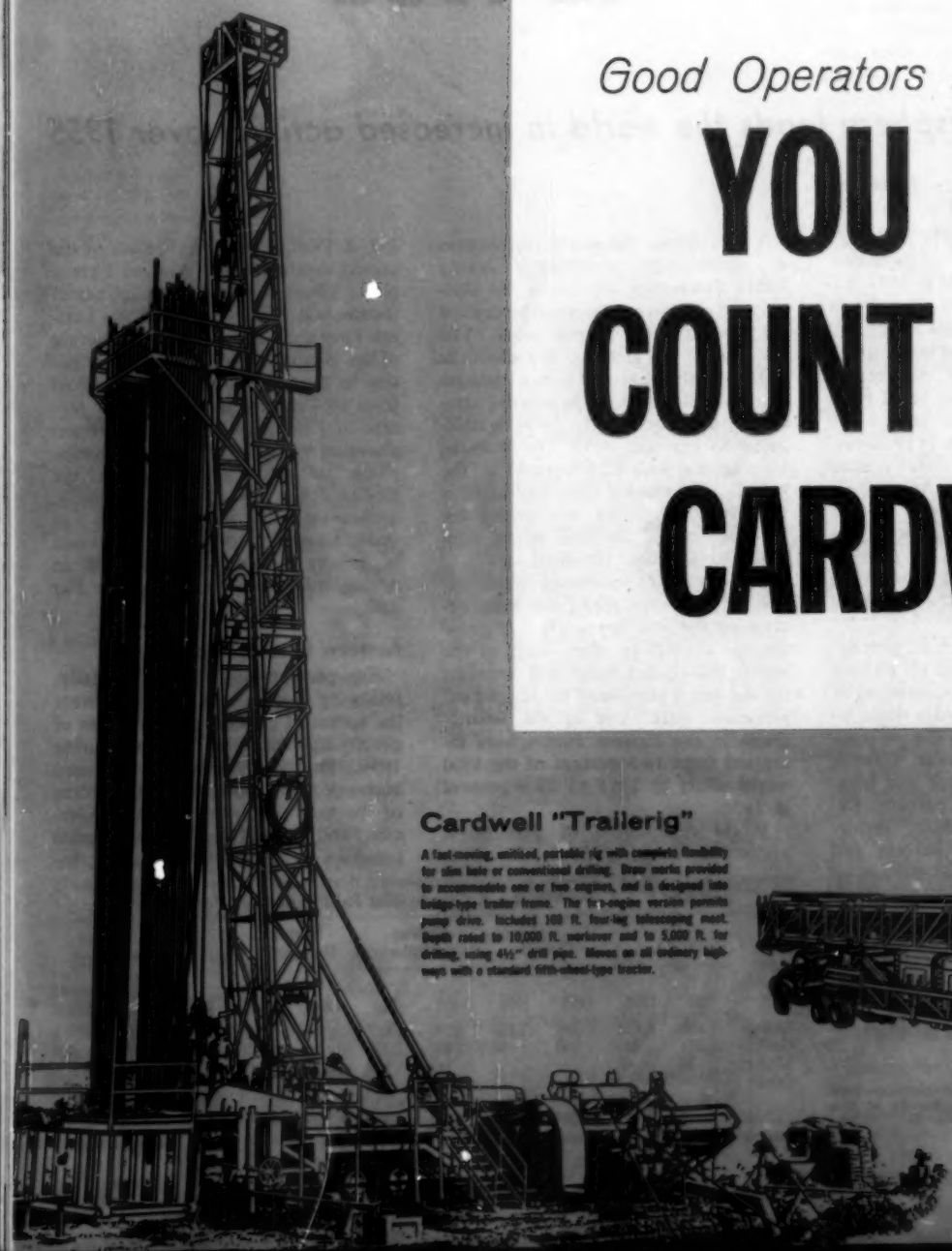

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A fast-moving, unitized, portable rig with complete flexibility for slim hole or conventional drilling. Draw works provided to accommodate one or two engines, and is designed into bridge-type trailer frame. The 2-engine version permits pump drive. Included 100 ft. four-leg telescoping mast. Depth rated to 10,000 ft. workover and to 5,000 ft. for drilling, using 4½" drill pipe. Moves on all ordinary highways with a standard fifth-wheel-type tractor.

Cardwell Model K200

Double drum rotary workover-servicing hoist offers minimum weight and rugged precision construction — with wide versatility in mounting. It can be truck-mounted and operated from truck power take-off or independent power. The K-200 may also be trailer mounted on various heights of Cardwell "Trailermasts." Unit is available with single or double leg pipe masts or structural telescoping masts. Servicing and workover depth rating is to 9,000 ft. The large sand line drum accommodates 13,150 ft. of 9/16" line. Nominal input horsepower is 240 H. P. Extremely easy to transport and rig up.

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Below is a list of a few of the operators using Cardwell equipment in the Four-Corners area:

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J. P. (Bum) Gibbins
Aztec, N. M.

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Bloomfield, N. M.

J. G. Roberts, Inc.
Aztec, N. M.

Christy Well Service, Inc.
Cortez, Colo.

George W. Riley
Aztec, N. M.

Fay Campbell
Cedar Hill, N. M.

Rota Cone Oil Field Operating Co.
Aztec, N. M.

Gardner Bros. Drilling Co.
Farmington, N. M.

Empire States Drilling Corp.
Farmington, N. M.

H. B. R. Well Service
Farmington, N. M.

Rio Arriba Drilling Co.
Cuba, N. M.

C. L. (Cluke) Meyers Drilling Co.
Cuba, N. M.

Signal Oil Field Service
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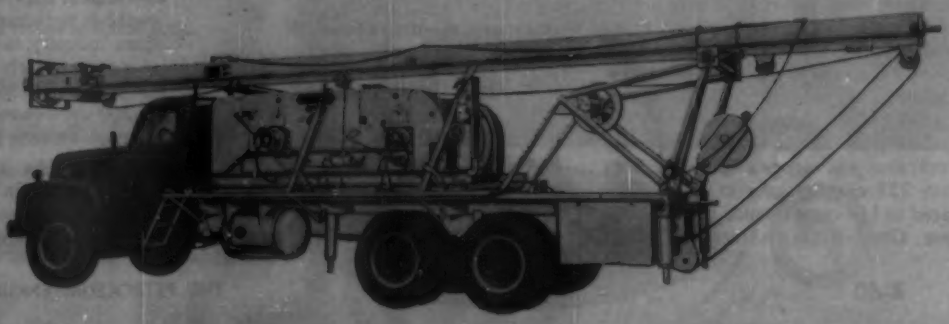
Cardwell Model K203

Double drum servicing hoist with power take-off designed for fast, lightweight mobility. Depth rating: 9,000 ft. for well servicing. The large sand line drum accommodates 13,150 ft. of 9/16" line. Unit is located well forward to allow ample storage for tools, blocks, and other equipment. Handles easily — on the road or in the field.



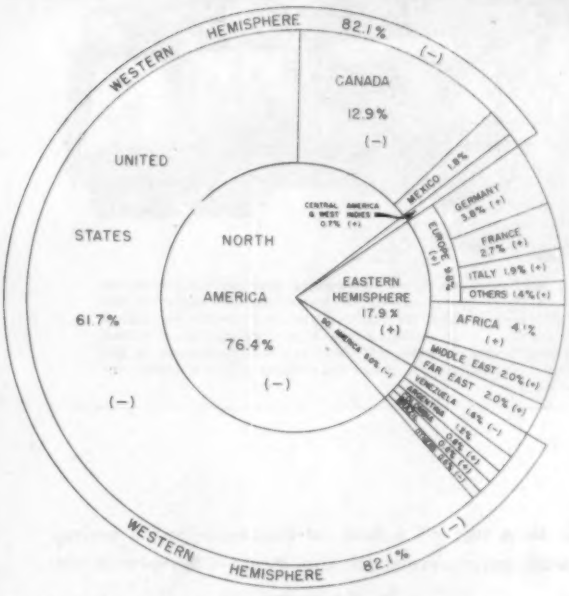


FIG. 1. World distribution of seismograph prospecting in 1956.

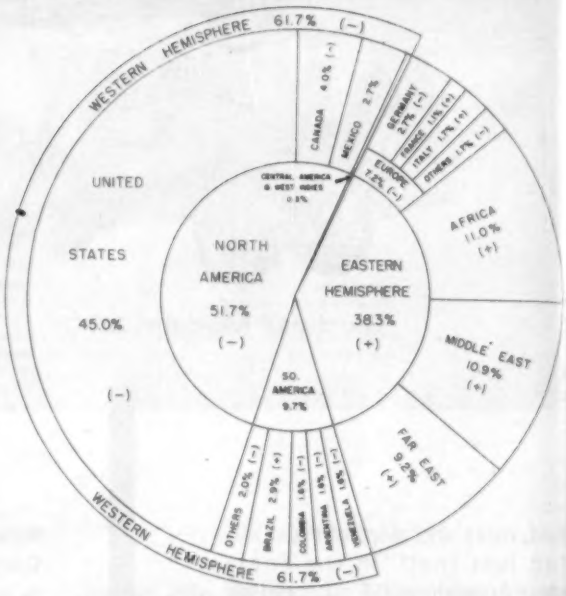


FIG. 2. World distribution of gravimeter prospecting in 1956.

creasing activity in Italy noted during the first six months of 1956 was reversed during the second half of the year. Total geophysical operations in Italy during the entire year were about equal to those in 1955. Other countries where some geophysical work was reported are: Austria, Greece, Netherlands, Portugal, Spain, Turkey (European), and United Kingdom.

Africa. Geophysical activity increased substantially on the African continent during 1956. Noteworthy increases in seismic work occurred in French Sahara and Libya. Gravity work also was stepped up in Libya. French Africa, where much of the increased activity occurred, accounted for 54.8 percent of all geophysics exploratory work in Africa during the year. Reduced activity took place in Egypt following political disturbances in that area. Other African countries in which geophysical work was conducted are: Angola, Belgian Congo, British Somaliland, East Africa, Somalia, Nigeria, and Madagascar.

Middle East. Increased activity in geophysics explorations in Middle East countries was reported during 1956. Total geophysical work of all types amounted to 475 crew-months, while in 1955 the total was 319 crew-months. Middle East seismic operations increased from 123 crew-months in 1955 to 200 crew-months in 1956. Gravity work also was stepped up in the area with 227 crew-months in 1956 compared to 118 crew-months the previous year. Greatest concentration of effort occurred in Iraq, Saudi Arabia, Turkey and the Persian Gulf. Most exploration work reported in Israel during the year was done the first six months as operations were curtailed during the last half of the year. Other areas in which some geophysical activity was reported are: Dhofar, Iran, Jordan, Kamaran (Red Sea), Kuwait, Quatar (offshore), and Syria.

Far East. Midyear reports indicated that geophysical activities in the Far East were declining. The indicated downward trend was, no doubt, due to incomplete information at that time. Actually, geophysical activity in the area increased in 1956 as compared to 1955. A total of 451 crew-months geophysical work of all types was reported in 1956. The 1955 total was 358 crew-months. Notable increases occurred in India and Pakistan. A considerable amount of work was carried out in Australia, Netherlands New Guinea, and Japan during the year. Other areas in which petroleum explorations were reported are: Indonesia, New Zealand and other islands, Papua, Philippines, and New Caledonia.

Western Hemisphere

South America. Geophysics exploration for petroleum continued high in South American countries in 1956, level of activity being about the same as in 1955. The greatest concentration of effort was in Venezuela where 175 crew-months seismic work and 35 crew-months gravity work were reported. Argentina ranked second with 132 crew-months seismic work and 36 crew-months gravity work. Brazil with 90 crew-months seismic work and 64 crew-months gravity work was third, and Colombia was fourth with 87 crew-months seismic work and 36 crew-months gravity work. Other countries in which geophysical operations were conducted are: Bolivia, Chile, Ecuador, Peru, and Uruguay. A significant number of magnetic surveys, both airborne and ground, were reported in Argentina, Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela. A limited number of airborne scintillometer surveys was reported in Brazil and Venezuela.

Central America and West Indies. Very little geophysical activity was reported in Central American countries during 1956. An average of five seismic crews were in operation in Cuba during the year. A small amount of gravity work also was done in Cuba. Seismic surveys amounting to a total of 17 crew-months were carried out in Jamaica, in Trinidad, and in the Bahamas.

Mexico. Explorations by geophysical methods were carried out by the petroleum industry in Mexico during 1956 at approximately the same rate as in 1955. Total 1956 operations consisted of 200 crew-months seismic work and 60 crew-months gravity work.

Canada. As in 1954 and 1955, a sharp decline in seismic explorations occurred in Canada in the early part of 1956. The number of crews in opera-

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FIG. 3. Distribution of seismograph prospecting in U.S. in 1956.

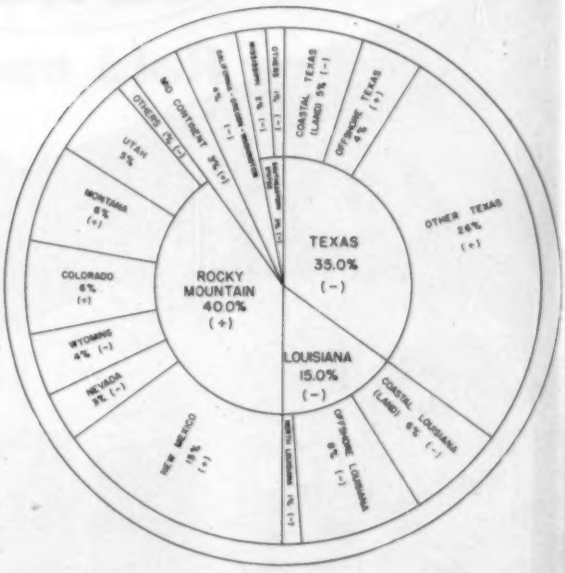


FIG. 4. Distribution of gravimeter prospecting in U.S. in 1956.

tion decreased from 164 at the end of 1955 to 89 in April 1956, a low point in seismic activity since the spring of 1950. With increases occurring during the following months, 117 seismic crews were in operation at the year's end. Average number of seismic crews in operation in Canada during 1956 was 119 compared to an average of 124 crews in 1955 and 128 crews in 1954.

An average of eight gravity crews was engaged in exploration in Canada during the year, the average in 1955 being 8.5 crews. Approximately 25,000 flight-miles of aeromagnetic work not shown in Table 1 was done in the western provinces of Canada during the year. This is estimated to be approximately 10 crew-months work and coverage of about 20,000 sq miles.

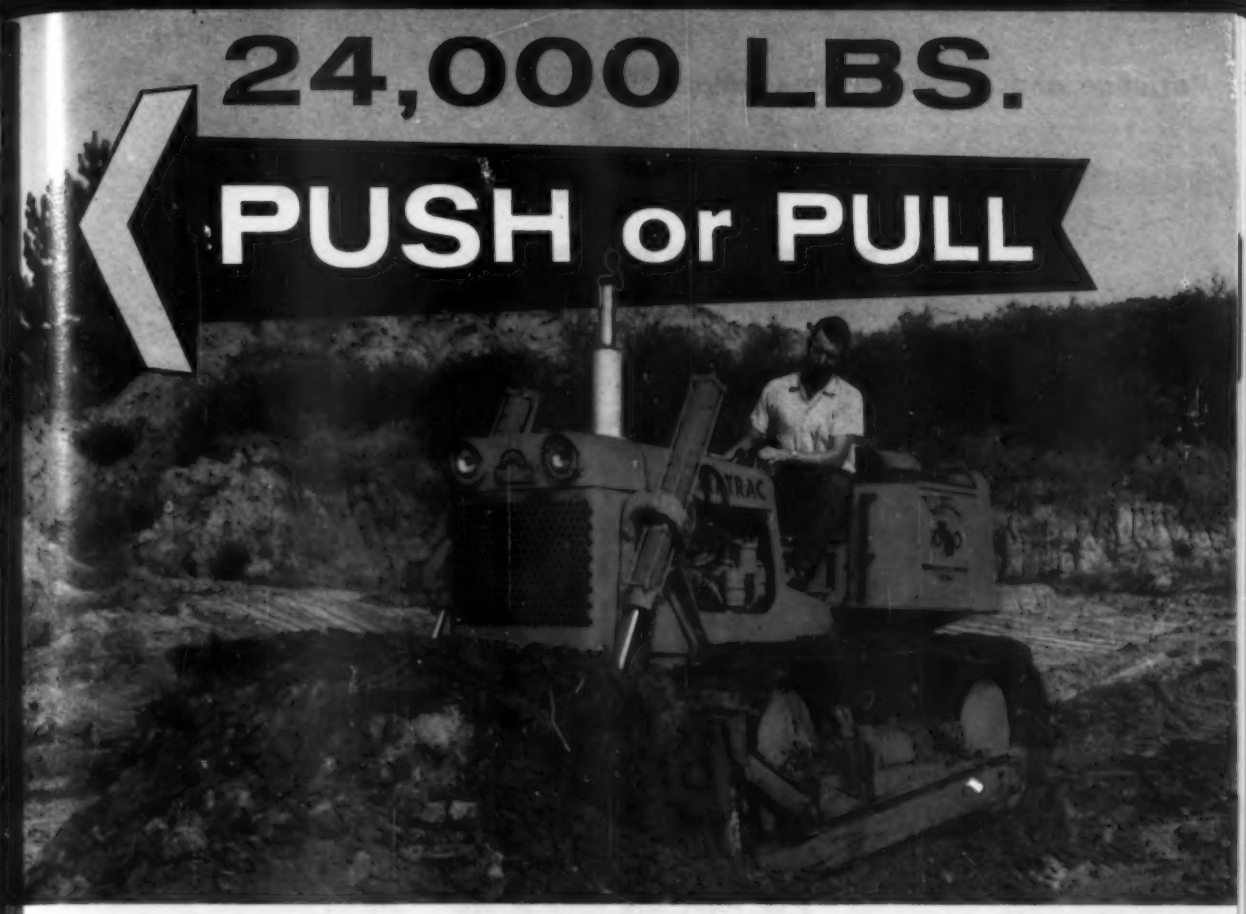
As in past years, the major portion of the geophysical activity in Canada in 1956 was in the western provinces. Some gravity work (27 crew-months) and a very limited amount of magnetic work was reported in the provinces of Ontario, Quebec, Prince Edward Island, and the Maritimes in eastern Canada. Alberta continues to lead in geophysical activity with a total of 978 crew-months seismic work and 52 crew-months gravity work during the year. Saskatchewan, with 230 crew-months seismic work and three crew-months gravity work, ranked second, and British Columbia with 182 crew-months seismic work ranked third. Remainder of the geophysical exploration work in the western provinces of Canada consisted of 33 crew-months seismic work and three crew-months gravity work in Northwest Territories and Manitoba.

United States. Geographic distribution of seismograph prospecting in the United States during 1956 is shown in Fig. 3. There were gains, as shown by increased percentages of the total U. S. activity, in the Rocky Mountain region, the southeastern states and the states of California and Louisiana. Decreases in percentage of total activity occurred in the Mid-Continent area and in Texas. Increased interest by the petroleum industry in the Four Corners area, the common corner of Colorado, Utah, New Mexico, and Arizona, brought an influx of seismic crews to that area during the year. This accounts for the significant gain in the Rocky Mountain region in spite of decreased activity in Wyoming, Montana, North Dakota, and other states of the region. Seismic work continued to increase throughout the year in Mississippi while little activity was reported in the other southeastern states. Activity continued on the decline in Oklahoma and Kansas where the major portion of the Mid-Continent seismic work was concentrated.

Some seismic work was done during the summer months in Alaska. An accurate accounting of the number of crew-months of Alaskan work is not available, but it is known to be small. Contract companies did approximately 57 percent of the U. S. seismic work in 1956 and 60 percent in 1955.

Distribution of gravimeter prospecting in the United States during the year 1956 is shown in Fig. 4. Due to stepped up activity in New Mexico, Colorado, Montana, and Utah, the Rocky Mountain area showed a large increase in gravity explorations in 1956. The Mid-Continent area showed a slight increase, but this area accounts for a very small part of U. S. total gravity effort. All other major areas showed decreased gravity activity. Decreased activity was reported in both Texas and Louisiana. Gravity exploration work in the two states combined amounted to 50 percent of the U. S. total in 1956, compared to 54.6 percent in 1955 and 62.5 percent in 1954. Contract crews did 66 percent of the total U. S. gravity work in 1956 compared to 61 percent done by contractors in 1955.

Seismic exploration in the offshore waters of Texas and Louisiana declined by 23.2 percent compared to 1955 while gravity activity increased by 1.2 percent. Activity in seismic work in the Gulf of Mexico began to decline following cancellation of a proposed sale of offshore leases in May 1956. Gravity work was continued, however, and reached a record high for the Gulf waters of 118 crew-months in 1956. In the offshore Louisiana area exploration crews did 225 crew-months seismic work and 80 crew-months gravity work in 1956. Corresponding figures for the year 1955 were 322 crew-months seismic work and 91 crew-months gravity work. In the Texas waters total seismic work in 1956 amounted to 47 crew-months, while in 1955 a total of 70 crew-months was reported. Exploration by means of the gravity meter increased from 14.5 crew-months in 1955 to 38 crew-months in 1956. ★ ★ ★



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UNUSUAL FISHING JOB in OKLAHOMA

Tubing back-off from the outside turns the trick — in time

Steven Gerolde, *Petroleum Engineer*
The Producers Supply and Tool Company
Fort Worth, Texas

THIS OKLAHOMA WELL had been producing from the Second Wilcox sand at a depth of 9425 ft for several years before dying as a result of natural depletion and water buildup.

In an attempt to kick the well off, a swabbing unit was rigged up and swabbing operations begun.

Trouble Begins

At a depth of 9300 ft, the swab appeared to stick momentarily and then dropped, taking the slack from the line. When an attempt was made to pull the swab, it was found to be stuck. Since the well had been producing salt water, it was believed that the swab had stuck in or dropped through a salt bridge. Sixty barrels of fresh water were introduced into the tubing string, going in on a vacuum — but the swab still could not be pulled. A strain was left on the ⅝-in. sand line for 24 hours, but upon attempting to retrieve it, the line parted at the crown of the mast and disappeared down the hole (Fig. 1).

With this turn of events, a pulling unit was rigged to pull tubing and recover the swab.

At original completion, the well had been loaded with 9.8 lb per gal mud behind a packer set at 9188 ft. It was assumed that 2-in. tubing string was EUE 8-round thread 4.70 lb SS, J-55 grade.

Working on the assumption that the tubing was J-55, a force of some 75,000 lb was pulled on the string with no results. A search of rceords revealed, however, that the tubing was H-40 grade. After having obtained correct tubing information, the string was worked for 1½ days during which a maximum of 85,000 lb was pulled. At no time was any evidence present which indicated the packer mandrel moving, so it was concluded that the tubing could not be pulled under existing circumstances.

Fishing for Sand Line

It was decided that an attempt should be made to fish out the old swab line. A second ⅝-in. line was rigged with two polish rods, jars and center spear. The old swab line was found at 641 ft and after 10 hours of fishing and many disheartening slip-offs, a firm hold was obtained. It had been decided that if enough line could be pulled out of the well, a rope knife would be run down to cut the old line at the rope socket. Then it would be possible to perforate the tubing above

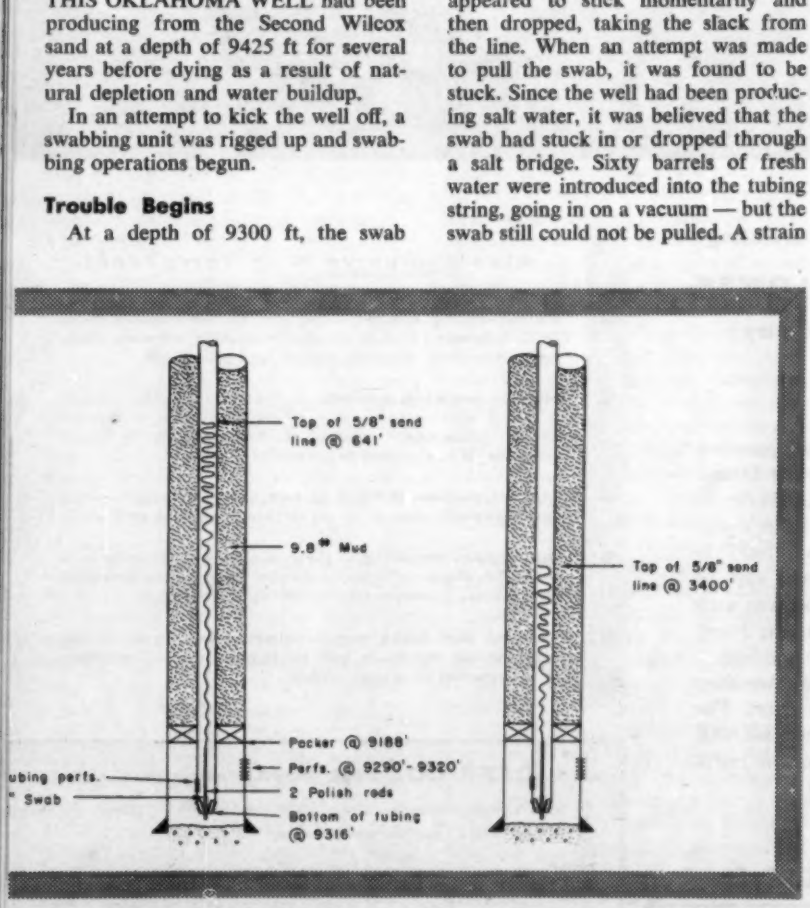


FIG. 1. **Well conditions** prior workover is shown in this schematic diagram of the well. Well has 7-in. casing set at 9495 ft, cemented to 9490 ft.

FIG. 2. **After fishing** 3400 ft of the ⅝-in. sand line, well condition was as indicated here.

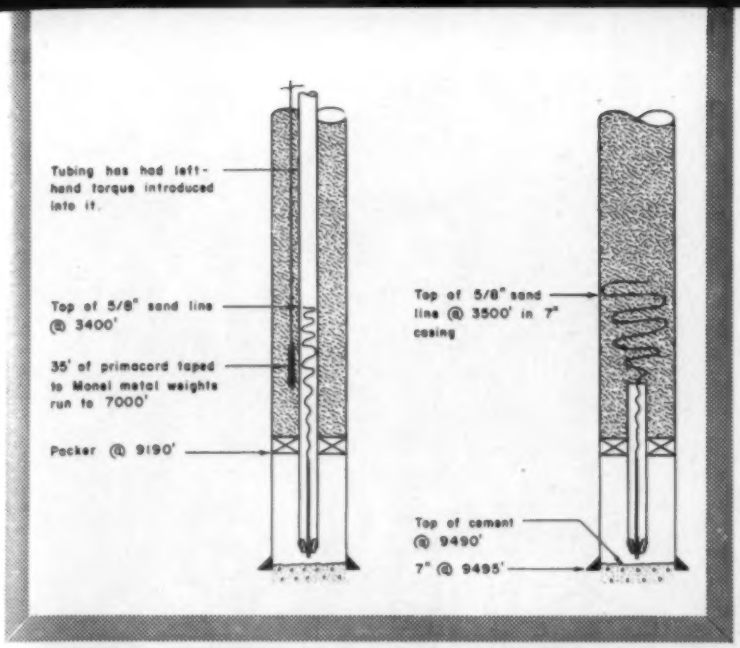

Tubing has had left-hand torque introduced into it.
Top of 5/8" sand line @ 3400'
35' of primacord taped to Monel metal weights run to 7000'
Packer @ 9190'

FIG. 3. **Back-off shot** is in place in the annulus prior to firing the shot, so that much of the tubing string could be pulled and provide more fishing "room" downhole.

FIG. 4. **After backing off,** 7000 ft of tubing was pulled. Top of the ⅝-in. sand line was now at 3500 ft.

the packer and circulate out all the mud from behind. It was felt that with the mud weight absent, the tubing might be pulled.

Upon attempting to pull the old line with the center spear, however, not enough slack was in the old line to permit it to come to the surface. Thus, it was necessary to whip the new line and jars. Finally 3400 ft of the old swab line were retrieved; it was very badly stranded and the fiber core had been popped the entire 3400 ft.

Use of Sucker Rod String Fails

Use of another sand line was considered too dangerous, so a string of ⅞-in. sucker rods was run along with two polish rods, jars and center spear. After 1½ days of fishing, only one 4-ft piece of old sand line was withdrawn. It was decided that something else should be attempted.

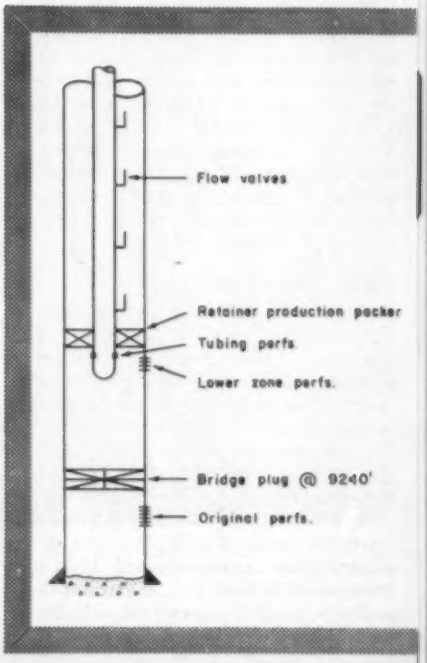
Tubing Backoff — from Outside

Since string shots had been used to free drill pipe from key seats, an attempt would be made to effect a tubing backoff — outside the tubing — at the lowest point possible, so that, if successful, the old swab line would be in the 7-in. casing where fishing would be easier.

Necessary left-hand torque was successfully introduced into the tubing; the string shot was taped to 35 ft of ½-in. monel weights and the shot was lowered into the well between tubing and casing. It was necessary to spud the shot several times, working it to a depth of 7945 ft. The shot failed to fire. Upon withdrawal, it was noted that the primacord had been pulled loose from the blasting cap.

The shot was again prepared and this time was spudded down to 8130 ft; again it would not fire. Withdrawal indicated that, again, the primacord had been torn loose from the blasting cap.

FIG. 5. **Recompletion** was successful at the conclusion of the workover and this unusual fishing job. Production was effected using gas lift.



Attempt, Re-Attempt, etc.

A third attempt was made, with the shot worked to 8130 ft. Again it would not fire. This time, upon attempting to withdraw the shot, it became fouled in the hole, evidently around the tubing. The tubing was worked for about 1½ days and the string shot came loose and was withdrawn intact.

A fourth attempt also failed. On this trip, the shot could not be lowered below 5046 ft, even though it was spudded. Since this was not deep enough, the shot was withdrawn without attempting to fire.

Success!

On the fifth try, the shot was rerigged and lowered to 7000 ft (Fig. 3). This time the shot fired. The tubing could be seen backing off. The string shot weights and shooting line were successfully withdrawn without incident. The tubing raised one foot, and 50 bbl of salt water pumped down the annulus to flush the mud out into the formation.

Tubing was pulled and the tally indicated that 7012 ft of tubing had been recovered (Fig. 4). Only damage noted

The Author

Steven Gerolde, petroleum engineer for the Producers Supply and Tool Company, was graduated from the University of Southern California in 1937 and started an oil field career at Ventura, California, for the Chanslor-Canfield-Midway Oil Company. In 1938 he went to West Texas for Gulf Oil Corporation and performed engineering trainee duties until 1939. At time of entry into Air Force in 1942 he was district petroleum engineer. Following World War II, Gerolde returned to Gulf Oil Corporation in Fort Worth and in 1954 advanced to division workover engineer. In 1955 he resigned from Gulf to become associated with The Producers Supply and Tool Company as petroleum engineer.

was two small curves in the last joint. Threads were in perfect shape.

Back for the Swab Line

Efforts were then resumed to pull the old swab line. A 13/16-in. drilling line was rigged with stem, two sets of jars, a 4⅜-in. three-prong grab and started in the hole. The old swab line was found at 3500 ft. The grab took hold and withdrew remainder of line complete with polish rods and upper portion of swab. The lower portion, which included the mandrel with cups, was left in the hole.

Tubing Worked

A string of 2⅞-in. OD 10.5 lb extra hole drill pipe was picked up and a 5¾-in. OD rotary releasing overshot dressed with 3⅛-in. slips, mills and rubbers was run in. The fish was found and caught at 7000 ft. Magnetic detector and chemical cutter were rigged up, but it was decided to work the tubing for awhile.

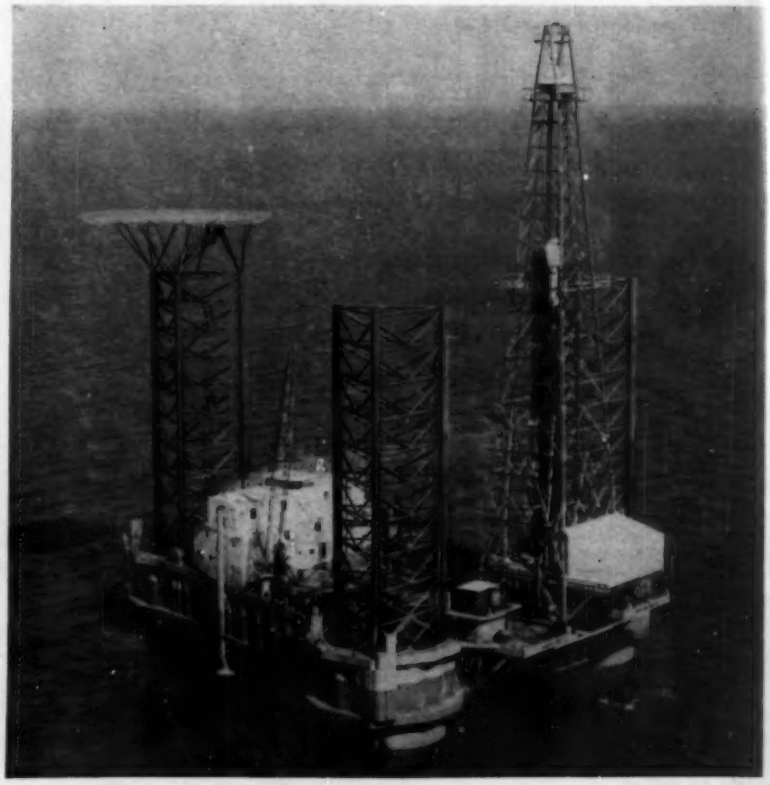
A force of 90,000 lb (16,500 lb above the weight of drill pipe) was applied with no movement noted. Then a force of 95,000 lb (21,500 lb above drill pipe weight) was exerted, with the packer mandrel moving for the first time. Tubing was again worked; this time a force of 105,000 lb (31,500 lb above weight of drill pipe) was exerted. At this point the mandrel was moving full 30 in. Continuing to work the mandrel and tubing, with a maximum of 115,000 lb pulling force exerted, resulted in freeing the packer. Remainder of the tubing was pulled without incident.

Root of Trouble

Withdrawal of the last joint of tubing brought with it the reason for the stuck swab. At original completion, the mud anchor had been orange-peel welded with a 1¼-in. opening. The swab machine operator had made a mistake in his depth calculation. Since he had underestimated the depth, the swab struck the orange-peel weld with such force as to spring the weld. It had allowed the swab to pass through the tubing, but with such a tight grip that the ⅝-in. swab line had failed—originally at the crown block and again at 3400 ft from fatigue.

New Completion

As the original pay section had reached its economic limit, it was decided to plug back for a new completion attempt up the hole. A bridge plug was set, tested and the well was perforated with both bullets and jets, then heavily acidized. Subsequent testing indicated that the new, untried pay section yielded oil in commercial quantities through the medium of gas lift (Fig. 5). * * *



'Mr. Cap' Sets Record In Fast-Moving Offshore Venture

From christening, to location, to its first producing well—all in 12 days—is the record-setting pace established by a new LeTourneau offshore platform operating in the Gulf of Mexico for Barnwell Offshore, Inc.

Christened "Mister Cap" at a two-day open house in New Orleans on November 1 and 2, the three-legged unit arrived at its first location in Block 25 of the Main Pass area off Louisiana on November 6. Well was spudded on the following day and successfully drilled to a total depth of 6359 ft for completion on November 14.

The heavy-duty mobile drilling barge was designed to operate in 85-ft water, even in the hurricane season, assuming a penetration of 15 ft of the three spuds into the ocean floor. Raising and lowering of the legs and platform are accomplished through a rack-and-pinion system. "Mister Cap" is 176 ft long (less the deck extensions) and 152 ft wide. Depth of the platform hull is 20 ft.

Power for the unit is supplied by three diesel-electric plants, each plant consisting of one 875-hp engine, two 502-kw d-c generators and a 400-kw a-c generator for ship's service. The 2500-hp drawworks is rated to drill in excess of 20,000 ft. The 140-ft derrick mounted on the barge carries a 480-ton traveling block and a 500-ton 7-sheave crown block. Mud-conditioning equipment consists of a twin shale shaker, a de-sander and a de-gasser. Each of two 1000-hp mud pumps has two independently connected 625-hp d-c motors.

Living quarters for 50 men include air conditioned sleeping, cooking, dining, and recreational facilities.

Following work on its first producing well, the platform was lowered on its spuds to the water, then towed 990 ft northwest to a second drilling location in Block 25 of the Main Pass area.

P 420.113

In Formation Testing, Treating, and Squeeze Cementing . . .

NEW METHOD CUTS RIG TIME

Idea eliminates round trips with tubing or drill pipe in well evaluations and completion operations

FIG. 1. **One trip does all** as the lower section tool of this new subsurface combination is lowered away for drillstem testing, squeeze cementing, perforating, treating, and simultaneous gamma-collar logging.

D. L. Farley
and H. E. Schwegman,
Halliburton Oil Well Cementing Company, Duncan, Oklahoma

CONSIDERABLE reductions in rig time involved in well evaluation and completion operations have been made by a new method that accommodates these operations without making a round trip with the tubing or drill pipe. This idea consists of the manner in which several operations, such as formation testing, cement squeezing, treating, perforating, and simultaneous gamma-collar logging can be performed without making a round trip with the drill stem between these operations.

The method involves a new retrievable valve tester which is used with a retrievable test-treat-squeeze packer which is a full-open, drillable packer. Advantages of the conventional formation test are combined with features of this multi-purpose packer which enables the performance of several operations with only one trip with the tubing.

The retrievable valve tester may be opened and closed to provide bottom-hole control in the same respect that can be obtained by conventional testing tools. A suitable bottom-hole choke is provided, and pressure data, including closed-in-pressure, is recorded on a sensitive bottom-hole pressure recording device.

The test may be evaluated without removing tubing from the well. Formation fluid recovered in the tubing can be reverse circulated if desired and the pressure recording device can be obtained immediately after testing operations are complete. Pressure readings can be used immediately to calculate potential of the tested interval to determine the advisability of well stimulation (Fig. 2). This stimulation technique then can be performed using the full-open, retrievable packer already in the well. If subsequent operations involving the use of the packer are not required, plans for the next operation can be made while the packer is being removed from the well.

FIG. 2. **Typical pressure chart** made by retrievable formation testing element. A — going in hole; B — hydrostatic mud weight; C — opening valve; D — initial flow pressure; E — final flow pressure; F — closed-in pressure; G — release of closed-in pressure; H — retrievable valve released; I — valve picked up with wireline overshot, and J — retrieving valve and pressure recorder by wireline.

Repeated operations involving the use of the retrievable valve tester may be performed without removing tubing from the well. If it is desired to run another formation test after treating, squeezing, or perforating, the testing tool can be re-set for this type operation. Converting the tool for making another formation test or for operations requiring a full-opening is done by either wire-line or pumping methods.

Equipment Used and How It Works

The retrievable valve tester is composed primarily of two tools, shown in

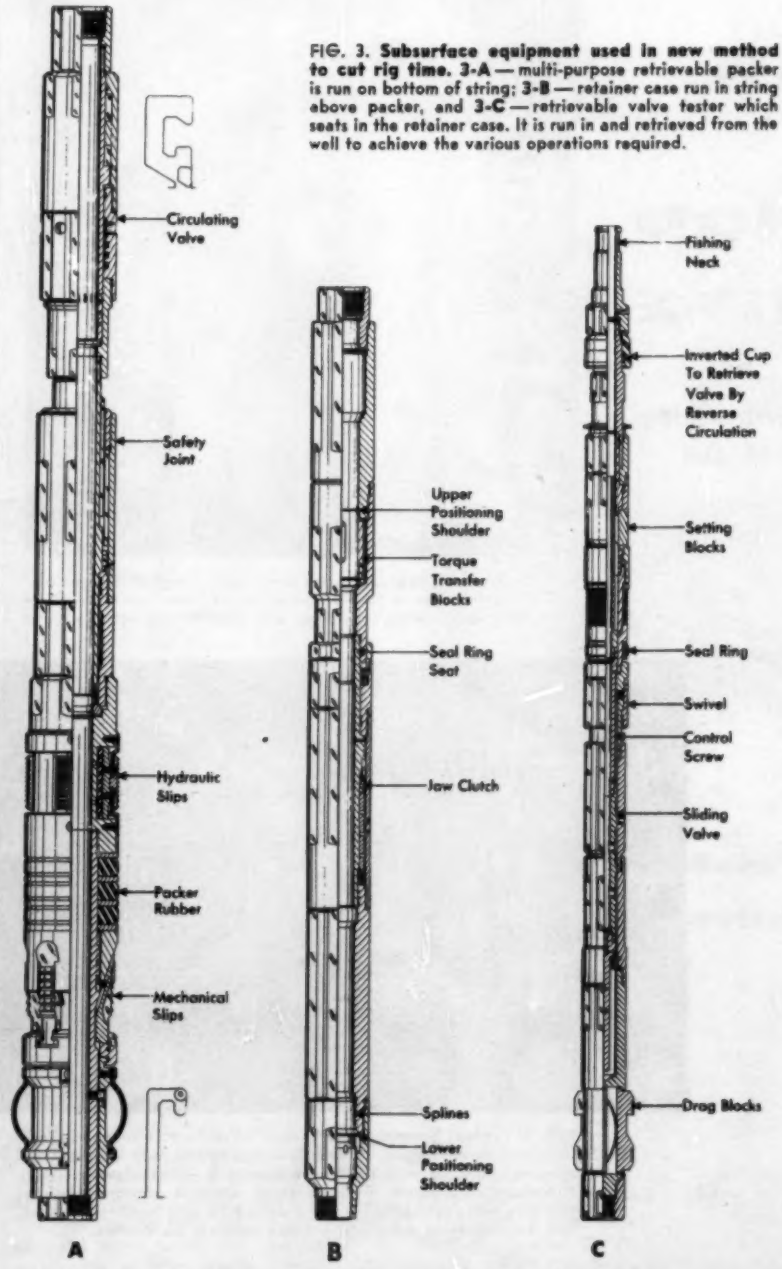


FIG. 3. **Subsurface equipment used in new method to cut rig time.** 3-A — multi-purpose retrievable packer is run on bottom of string; 3-B — retainer case run in string above packer, and 3-C — retrievable valve tester which seats in the retainer case. It is run in and retrieved from the well to achieve the various operations required.

Fig. 3. A retainer case is run in the well in the tubing string above the packer and remains a part of the tubing string during all operations. The retrievable valve fits inside the retainer case and completes the tool thereby making it possible to obtain various positions of open and closed for testing. The retrievable valve can be released, then returned to surface by means of wireline or pumping methods. It can be replaced in the case by wire line or pumping when another test is desired.

Retainer case has two sections. The retainer case is composed of two sections that rotate relative to each other when sufficient tubing weight is applied. The two sections, shown in Fig. 3-B, are locked together by spring-loaded lugs that disengage when sufficient weight is applied to overcome the spring. When weight is not applied, the case will transmit rotation so operation of the tools below the retainer case is permitted. Also, the case will not swivel going in or out of the hole which keeps from disturbing the position of the retrievable valve. Each section of the retainer case contains a recess which serves to lock the retrievable valve in the retainer case so the valve can be operated by rotation of the tubing when the tubing weight is applied.

Retrievable valve. The retrievable valve is also composed of two main sections that will rotate relative to each other, thereby making it possible to operate a screw type mechanism which moves a sliding valve. The sliding valve has "O" rings that slide over ports to obtain various positions of open and closed for testing.

The retrievable valve also consists of a packing element, drag blocks, and setting blocks. Packing element seals in the bore of the retainer case. Drag blocks serve to locate the valve in its proper position in the case and to spline the lower section of the valve to the lower section of the case. Setting blocks are used to spline the upper section of the valve to the upper section of the case and to lock the valve in the case to prevent the valve from being forced up the tubing by pressure from below.

Operation of tool. Schematic dia-

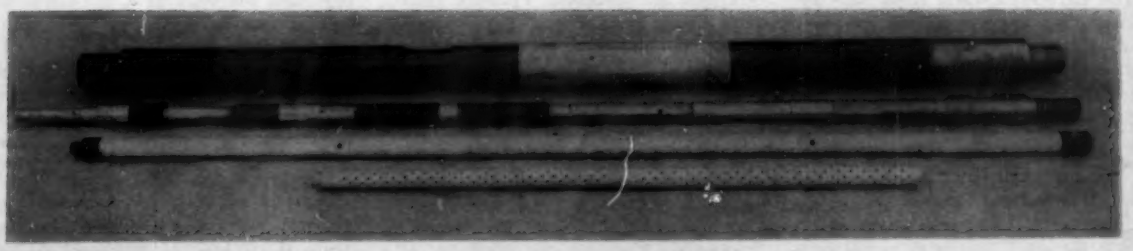
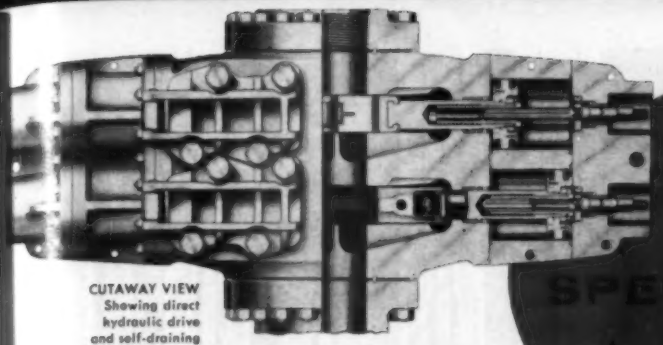


FIG. 4. **Component parts of retrievable valve tester.** From top to bottom are the retainer case (Fig. 3-B), retrievable valve (Fig. 3-C), pressure recorder running case and strainer. Top of each item is at left.



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Showing direct hydraulic drive and self-draining ram compartments.

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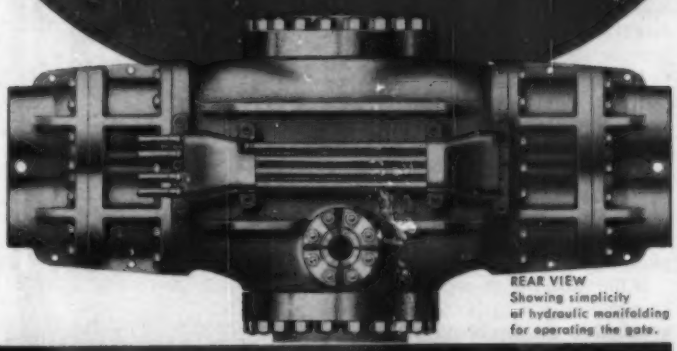

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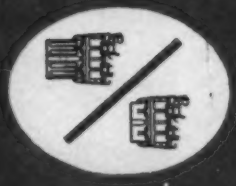

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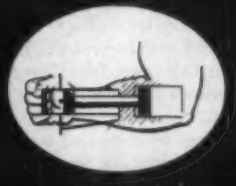

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grams of Fig. 5 illustrate the operation of this equipment. When the retrievable valve is set in place in the case and the case clutch is disengaged, right hand rotation of the tubing will then operate the valve. The valve is first opened for testing, then closed to take a closed-in-pressure recording on a sensitive pressure recording device, then opened again for equalization of pressure across the valve, then closed and released from the retainer case. Further rotation will not damage the tool as the screw mechanism becomes disengaged. The second open position, which is designated for equalization of pressure, can be used for reverse circulation before the valve is released or to provide another opening for testing.

If it is desired to test before any other operation, the retrievable valve, with pressure recorder attached, is locked in the case at the surface. Tool is run in with or without water cushion, whichever is desired. After testing operations are complete and the valve has been released, it can be retrieved by pumping or by wire line overshot.

If the valve is returned to the surface by pumping, it is caught in a lubricator attached to the top of the testing control head. If the valve is retrieved by means of wire line and overshot, the releasing overshot is run with link jars and sinker bar so that it can be released if necessary by downward jarring with the jars. After retrievable valve has been returned to surface, tubing string is then full open for other operations.

Methods of setting valve. If it is desired to re-set the valve in the case it can be set by wire line or by pumping or a combination of both. Here are some of the methods that may be used:

1. Valve can be pumped down until it shuts off in the case. Then it can be locked in place by jarring with simple wire-line equipment.
2. Valve can be pumped down and locked in place with pump pressure. This is done by pumping the valve down with a tubing plug on top of it.
3. A tubular sinker bar can be attached to the upper part of the valve and the valve can be pumped down to the case. When valve lands, inertia of the bar will lock the valve in place.
4. With the swab cup removed, valve can be dropped down the tubing and followed by the wire-line setting equipment.

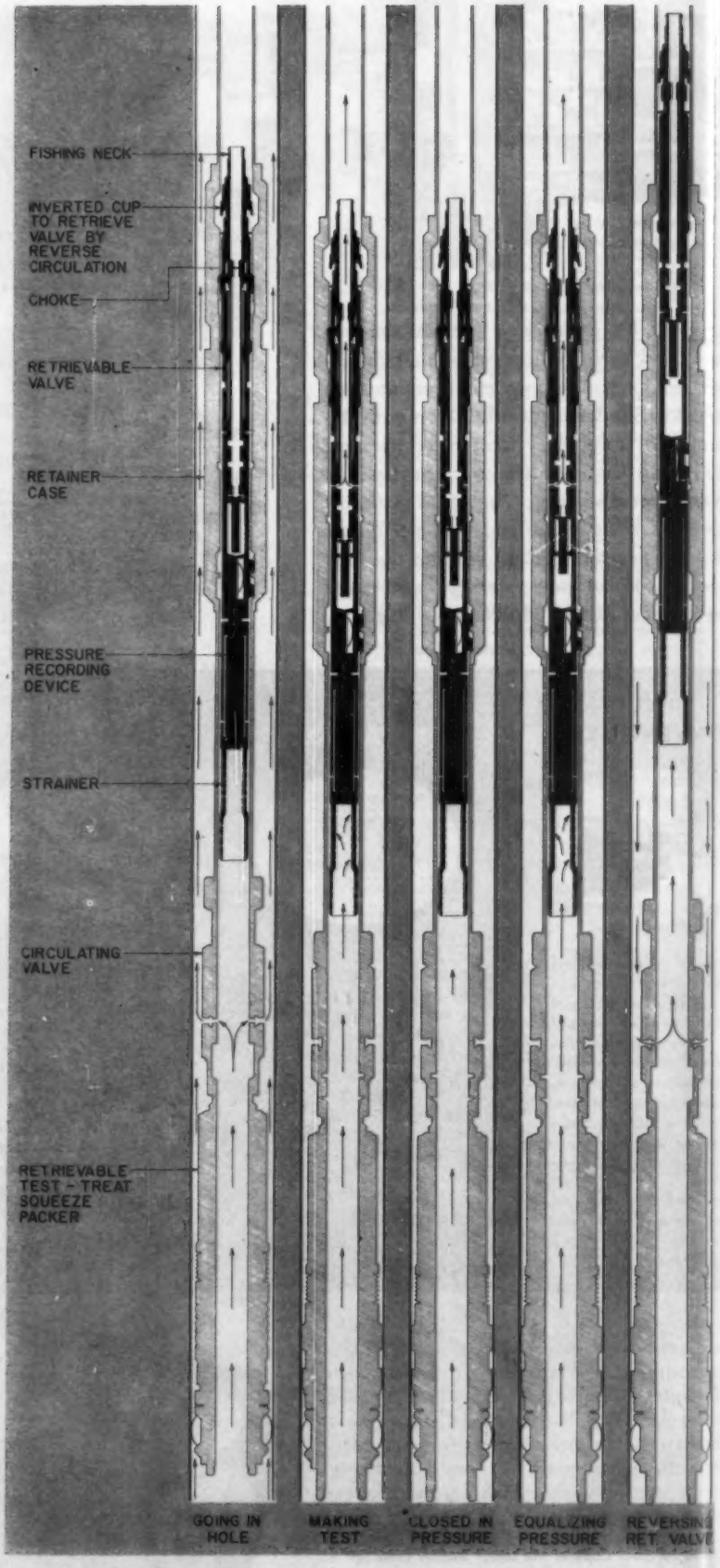

FIG. 5. **How equipment is used** is illustrated in the five drawings at right, showing how a formation test is made and how retrievable valve is reversed out of the hole.

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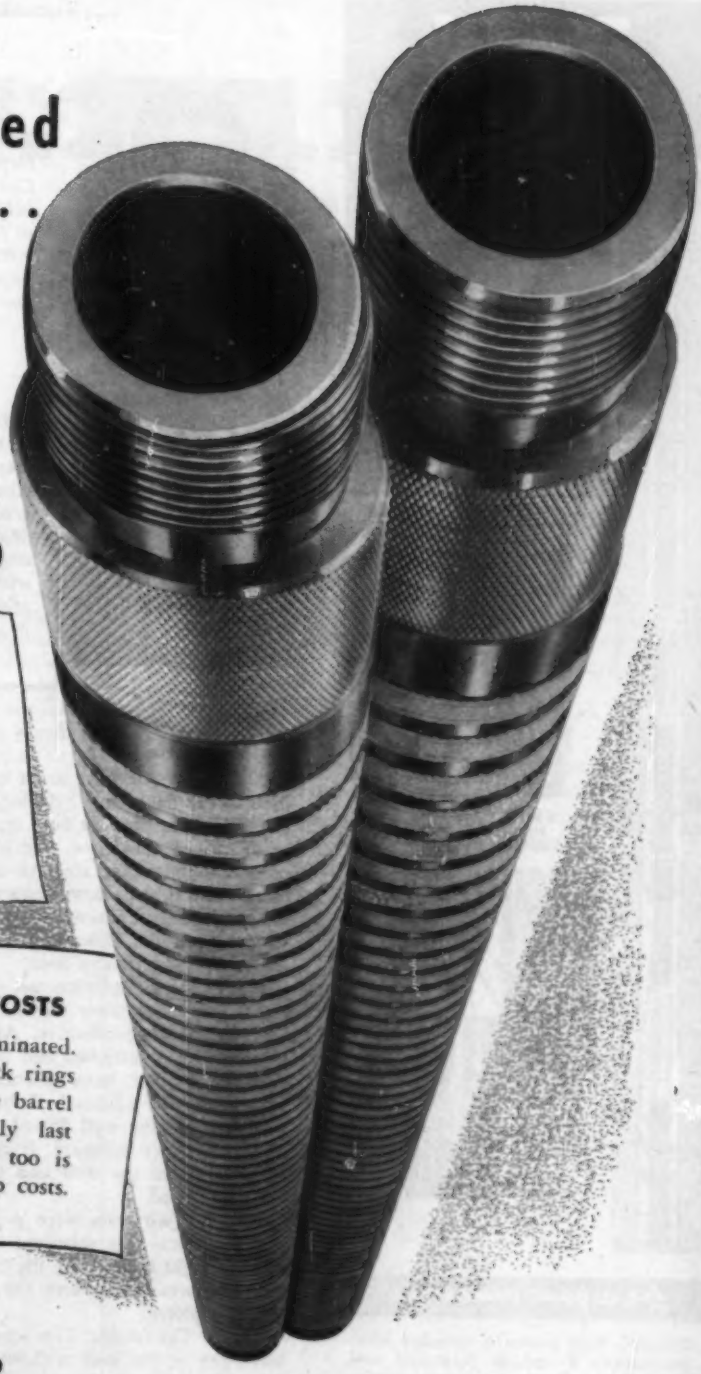

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THE AUTHORS

Dave L. Farley is a mechanical engineer in the Tool Development Section of the Engineering Department of Halliburton Oil Well Cementing Company at Duncan, Oklahoma, a position he has held for the past 3½ years. A 1954 graduate of Oklahoma A&M College with a BS degree in mechanical engineering, Farley joined Halliburton in June of that year and has worked with the company since.

Harry E. Schwegman is a development engineer in the Tool Development Section of the Engineering Department of Halliburton Oil Well Cementing Company, Duncan, Oklahoma. He was graduated from the University of Oklahoma in May 1947, with a BS degree in mechanical engineering. In June 1947, he began his career with Halliburton, and for the past few years has specialized in the company's tool development program as a development engineer.

Field Experience

The retrievable valve tester has been used in the field since February 1956, at which time the first field runs were made. Since that time, the tool has been in a continuous stage of development. The tool is now being used in most of the Gulf Coast areas and with very good results. Descriptions of some actual job experiences are:

No. 1. Initial drillstem test with the retrievable valve tester showed formation to be non-productive. After the tool had been retrieved and the pressure chart had been checked, the formation was acidized. Tubing was swabbed and the well flowed oil with 300 psi surface pressure. Packer was removed from the well and the well was completed.

No. 2. Two tests were performed and one zone was squeezed with cement in eight hours from the first time the tester was opened until the squeeze was completed.

No. 3. The retainer case and packer were run in the well without the retrievable valve. Perforation fluid was placed down the well, then the casing was perforated with a tubing gun. The well flowed oil. The retrievable valve was placed in the tubing at the surface under pressure. The valve dropped and landed in the retainer case. A sinker bar was lowered on a measuring line and the valve was seated. Closed-in-pressure was recorded then the valve was released. Valve was then retrieved with measuring line and overshot. The circulating valve above the packer was opened and the test was reversed out. Packer was removed from the well.

No. 4. When the tester opened the well blew a few minutes then died. When valve was released, blow at the surface resumed. Salt water flowed and carried the valve to the surface. Pressure recorder chart showed the choke plugged soon after the tester opened. On this job, a test was obtained even though the choke plugged.

No. 5. Well flowed gas when the retrievable valve tester was opened. Before the clock in the pressure recorder expired, the tester was closed for a closed-in-pressure recording, then tool was opened again to continue the test. The valve was released and the flowing gas carried it to the surface. Well was then fractured without exposing the formation to the drilling mud.

On hundreds of other jobs there have been various combinations of four or five operations such as testing, fracturing, etc., performed on one or more formations with only one trip with the tubing. It would be difficult to estimate the time saved. In many instances, the same operations could not be duplicated by conventional means, such as treating a well after a drillstem test without letting the drilling mud back on the formation, or obtaining a test even though the bottom-hole choke plugged when the tester opened. Versatility of this method is continuously being revealed in new and better ways to perform well evaluation and completion operations. ★ ★ ★

Desk Calculator or Computer performs . . .

Non-Graphical Solution of Back-Pressure Tests on Gas Wells

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C. J. Walker
Natural Gas Research Engineer
U. S. Bureau of Mines, Bartlesville, Oklahoma

Gas well characteristics are calculated directly from the back-pressure equation, allowing use of computers to save time, supply unique values of data normally obtained by tedious graphical approximation

RESULTS of standard back-pressure tests of gas wells usually are presented and interpreted in the form of graphs on log-log paper. Well characteristics then are calculated from such graphs as originally described in Bureau of Mines Monograph 7.[1] Such tests are required by many state regulatory bodies and supply much of the information used in gas engineering studies. Therefore, thousands of such graphs are plotted every year. A rapid and accurate method, capable of solution with a desk calculator or computer, has been developed for the direct calculation of gas-well characteristics.

The work upon which this report is based was done under a cooperative agreement between the Bureau of Mines, U. S. Department of the Interior, and the American Gas Association.

Back-pressure test results commonly are described by the equation,

$$Q = C\,(P_c^2 - P_w^2)^n$$

where:

Q = rate of flow, Mcf per day at 14.73 psia and 60 F,
C = performance coefficient of the well,
P_c = wellhead shut-in pressure, psia,

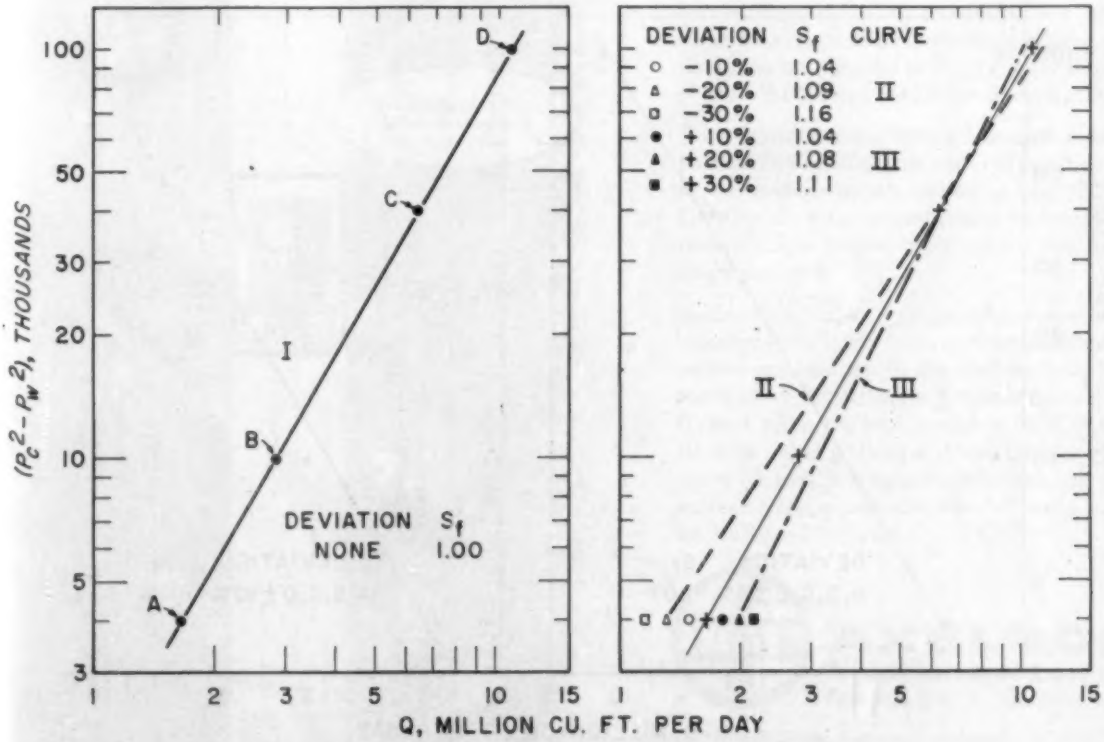

FIG. 1. **Effect of deviations** in single Q value on standard deviation factors.

P_w = static wellhead working pressure, psia, and

n = a numerical coefficient characteristic of the well, usually referred to as "slope."

If the back-pressure equation is expressed in the form,

$$\log Q = n \log (P_c^2 - P_w^2) + \log C,$$

it assumes the familiar form of a linear equation, $y = mx + b$, which can be solved by the least squares method as pointed out by Ferguson.[2] This method has not found wide acceptance because of inherent limitations.

'Least Squares' System

The least squares method permits only the drawing of the best line through a set of data points and gives no indication of how scattered the points may be. However, principles of the statistics of limited data as described by Youden,[3] may be combined with the least squares method to provide the information available from the usual graph.

MATHEMATICAL METHOD

The least squares method is described by most mathematics texts and its application to back-pressure testing by Ferguson.[2] From the equations above, let $\log Q = y$, $\log (P_c^2 - P_w^2) = x$, N = number of data points, and Σ = sum of values. Then values of log "C" and "n" are expressed by:

$$\log C = \frac{\Sigma y \Sigma x^2 - \Sigma x \Sigma xy}{N\Sigma x^2 - (\Sigma x)^2},$$

and

$$n = \frac{N\Sigma xy - \Sigma y \Sigma x}{N\Sigma x^2 - (\Sigma x)^2}.$$

Once values of "C" and "n" are known, they may be substituted in the back-pressure equation to solve for the "open flow" or for deliverability[4] (Q) at given levels of $(P_c^2 - P_w^2)$.

Youden Method

A measure of the "scatter" of the points from a straight line may be calculated by the method of Youden.[3] If the standard deviation of a single "y" (log Q) measurement is represented by "s," then

$$(N-2)s^2 = \Sigma y^2 - \frac{(\Sigma y)^2}{N} - \frac{\left(\Sigma xy - \frac{\Sigma x \Sigma y}{N}\right)^2}{\Sigma x^2 - \frac{(\Sigma x)^2}{N}}.$$

This equation looks rather complicated but most of the data already will have been calculated for the least squares solution. Finally, the antilogarithm of "s" is taken to give a "standard deviation factor," (S_f). This factor approaches unity as the data points fall closer and closer to a straight line. Experience shows that a value below about 1.07 is indicative of data points that appear acceptably close to a straight line on the usual graph.

Example

Q* $(P_c^2 - P_w^2)$* log Q log $(P_c^2 - P_w^2)$

Point	Mcfd	Thousands	y	x	xy	x^2	y^2
a	1,567	4	6.1951	3.6020	22.3147	12.9744	38.3793
b	2,948	10	6.4696	4.0000	25.8780	16.0000	41.8544
c	5,960	40	6.7752	4.6020	31.1796	21.1784	45.9033
d	11,209	100	7.0496	5.0000	35.2475	25.0000	49.6954
			26.4893	17.2040	114.6197	75.1528	175.8324
			Σy	Σx	Σxy	Σx^2	Σy^2

$N = 4$; $(\Sigma x)^2 = 295.9776$; $(\Sigma y)^2 = 701.6830$

Now: $$n = \frac{4 \times 114.6197 - 26.4893 \times 17.2040}{4 \times 75.1528 - 295.9776} = \frac{2.7569}{4.6336} = 0.595.$$

$$\log C = \frac{26.4893 \times 75.1528 - 17.2040 \times 114.6197}{4 \times 75.1528 - 295.9776} = \frac{18.8278}{4.6336} = 4.0633.$$

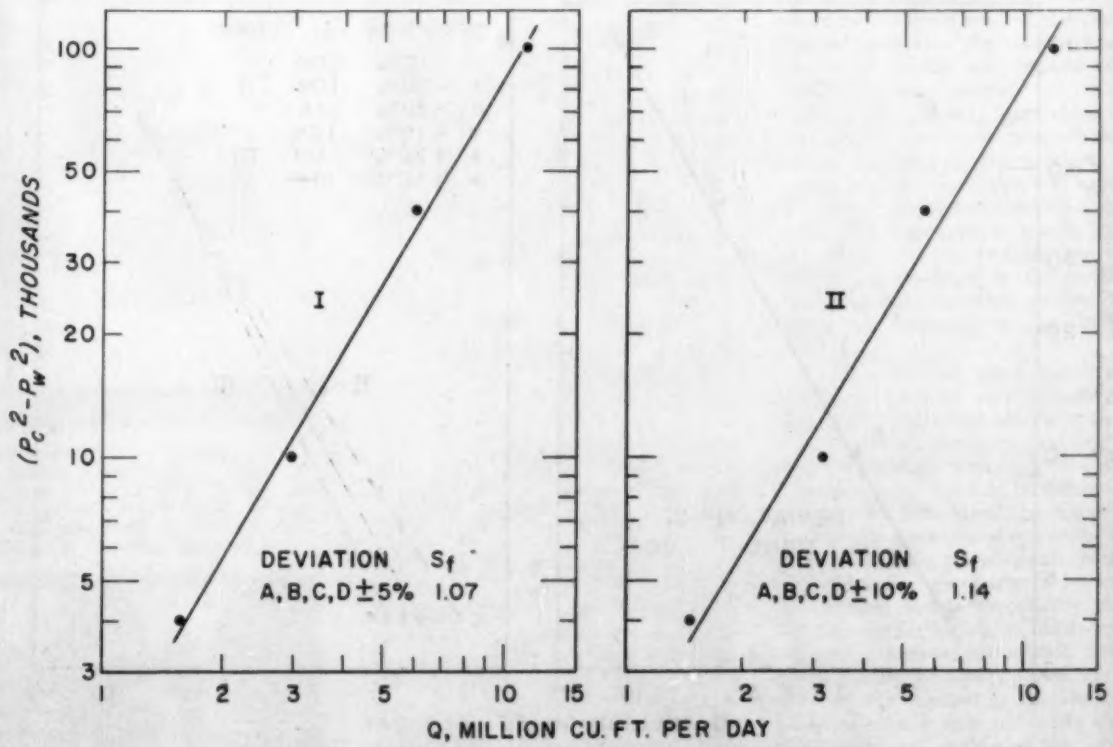

FIG. 2. **Effects of erratic deviations in Q values on standard deviation factors.**

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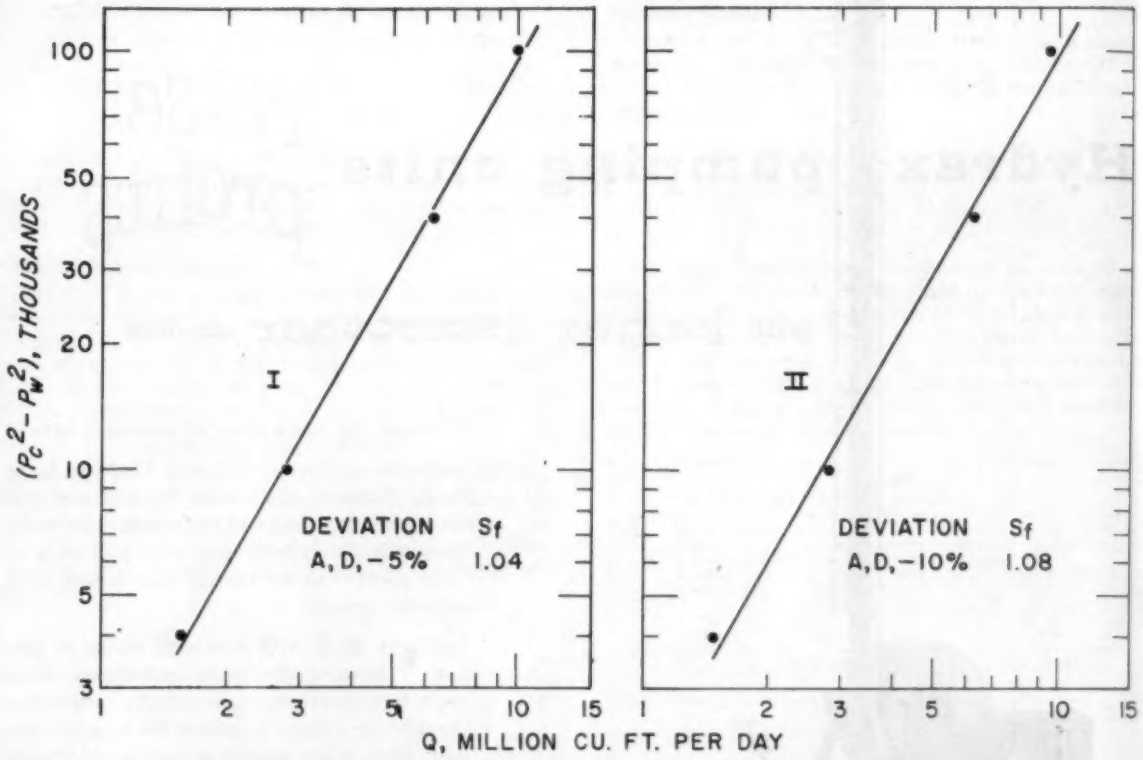

FIG. 3. **Effect of directional deviations** in Q value on standard deviation factors.

$$C = 11{,}570 \text{ cfd or } 11.57 \text{ Mcfd},$$

$$\text{and } (N-2)s^2 = 175.8324 - \frac{701.6830}{4} - \frac{\left(114.6197 - \frac{17.2040 \times 26.4893}{4}\right)^2}{75.1528 - \frac{295.9776}{4}},$$

$$= 0.0016,$$

$$s^2 = 0.0008;\ s = 0.0283,$$

and antilog s = standard deviation factor $(S_f) = 1.07$.

*Rate of gas flow commonly is expressed in *Mcf* per day and squared pressures in thousands. However, the values are converted to integers before taking their logarithms.

Computer Speeds Processing

These calculations may be performed readily with a common desk calculator. An automatic model equipped for cumulative multiplication speeds the calculation by obviating the individual products shown in the example. A small electronic punch card computer controlled by externally wired plug-boards and with auxiliary tabulating equipment has proved easily applicable for the solutions required. Each problem consists of three readings of two entries with appropriate coding. It was necessary to run the cards through this computer four times for the entire calculation because the computer could store only a few sets of numbers. Once the plug-boards were wired and checked (requiring about two hours of technical service) clerical personnel processed 100 cases per man-day with practically no technical supervision. About five man-hours were required to punch and verify the raw data. With larger computers, it would be possible to process the data much more rapidly and with less preparation.

Slight modifications of the method allow its use to detect curvature of the line or deviations of a single point.

Effects of various kinds and amounts of data-point deviations on the positions of the lines and on the standard deviation factors are shown in Fig. 1, 2, and 3. Results illustrated in these figures are summarized in Table 1.

TABLE 1. Effect of data-point deviations on back-pressure curves and standard deviation factors.

Fig.	Curve	Deviations: Points	Deviations: %	n	Flow Rates, Mcfd: C	Flow Rates, Mcfd: Q_{10}	S_f
1	I	none	none	0.580	13.4	2,808	1.00
	II	a	— 20	.638	7.1	2,550	1.00
	III	a	+ 20	.532	22.6	3,037	1.00
2	I	a,b,c,d	± 5	.595	11.6	2,775	1.07
	II	a,b,c,d	± 10	.610	9.9	2,736	1.14
3	I	a,d	— 5	.580	13.1	2,736	1.04
	II	a,d	— 10	.580	12.7	2,663	1.08

These examples indicate the utility of the method and the facility with which the scatter of data points is shown by the standard deviation factor. Additional advantages are in the comparative ease of storing tabulated rather than graphical data and more extensive use of less highly trained personnel. The rapid mathematical method described permits the use of either a desk calculator or computer to supply unique values of data normally obtained from the results of back-pressure tests by tedious graphical approximation.

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2. Ferguson, J. W. "A Critical Analysis of the Application of the Back-Pressure Method in Studies of Gas Reserves," *The Petrol. Eng.*, Vol. 13, November 1941, pp. 50-58.
3. Youden, W. J. "Statistical Methods for Chemists," John Wiley & Sons, New York 1951, 126 pp.
4. Walker, C. J., Corliss, E. R. Miller, J. S., and Dunning, H. N. "Deliverability Tests on Gas-Storage Projects," GSTS-57-5, American Gas Association, 11 pp. 1957; "How Gas-Wells Behave," *The Petrol. Eng.*, Vol. 29, August 1957, pp. D-35-40, September 1957, pp. D-29-31.

★ ★ ★

The SEG Executive Council

Incoming officers of the Society of Exploration Geophysicists receive the reins from retiring executives. Outgoing officers are, left to right: Editor Norman Ricker, The Carter Oil Company, Tulsa; Secretary-Treasurer John C. Hollister, Colorado School of Mines, Golden, Colorado; Vice President John P. Woods, Atlantic Refining Company, Dallas; President Roy F. Bennett, Sohio Petroleum Company, Oklahoma City. New officers are, continuing left to right: President O. C. Clifford, Jr., Atlantic Refining Company, Dallas; Vice President Ben F. Rummerfield, Century Geophysical Company, Tulsa; Secretary-Treasurer Howard E. Itten, Empire Geophysical, Inc., Ft. Worth; Editor L. Y. Faust, Amerada Petroleum Company, Tulsa.

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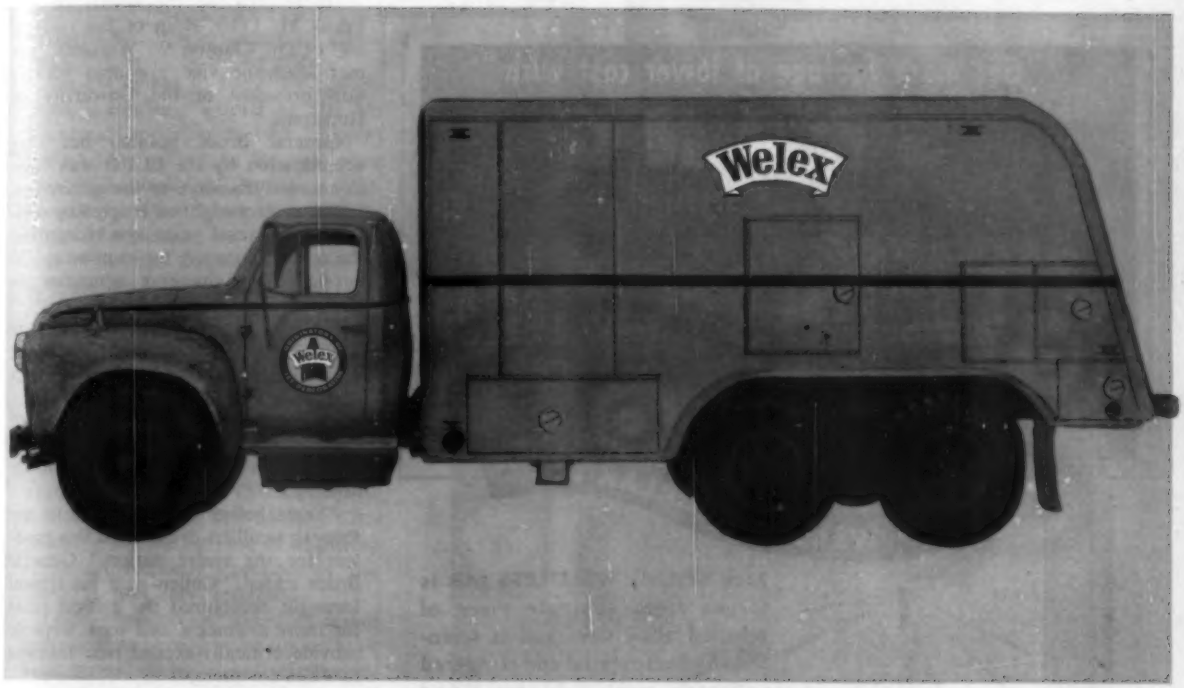

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Engineering Departments At University of Houston Accredited by ECPD

Five departments of the Cullen College of Engineering at the University of Houston have been accredited by the Engineers' Council for Professional Development, Lt. General A. D. Bruce, chancellor of the University, announced recently.

M. D. Hooven of New York City, ECPD president, notified General Bruce that the departments of chemical, civil, industrial, mechanical, and petroleum engineering have been approved after inspection by ECPD committees in Houston last summer and the submission of detailed studies regarding curricula, faculty and physical facilities.

ECPD is the officially recognized national accrediting agency for schools and colleges of engineering. Its membership includes various societies within the profession, as well as related organizations such as the National Council of State Boards of Engineering Examiners and the American Society of Engineering Education.

"This accreditation of our departments of engineering is a fine tribute to many years of hard work and progress by the engineering faculty at the University of Houston, and by the leading industrialists and engineers of this area who serve on our advisory committee for the Cullen College of Engineering," General Bruce stated.

He emphasized the efforts of Dr. Frank M. Tiller, dean of the college, and of Dr. Clanton W. Williams, former academic vice president who is now president of the University of Houston.

General Bruce pointed out that accreditation by the ECPD was "due in no small measure to the generosity, vision and foresight of Hugh Roy Cullen, who several years ago recognized the critical necessity for improving scientific and engineering education in America."

He and Mrs. Cullen, through the Cullen Foundation, announced the gift of a new college of engineering last March, and final plans for the facility are now being completed. By action of the Board of Governors, it has been named the Cullen College of Engineering.

"Years before the launching of the Russian satellites dramatized this problem for the entire nation," General Bruce added, "Cullen with his typical foresight recognized the critical need for more engineers and took steps to provide critically-needed new training facilities for them.

"His vision is now justified, and it is fitting that the long, hard work of the engineering faculty at the University of Houston has brought the national accreditation that will mean another great step forward in meeting the need for men trained in science and engineering."

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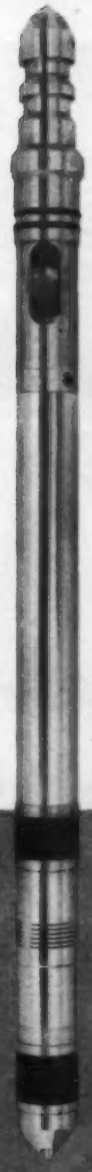
Drilexco Operations Extended To Bolivia

Drilling and Exploration Company, Inc., Dallas, Texas, engaged in the production of oil and gas in the United States, and in contract drilling in this country and foreign countries, has announced that it is extending its activities into Bolivia, South America.

On December 6, 1957, six concessions, comprising a total of 500,000 hectares (approximately 1,250,000 acres), by executive decree were granted to Bolivian Petroleum Corporation, a wholly owned subsidiary. These concessions are located in an area of eastern Bolivia considered to be most favorable for development of oil or gas. Major companies holding concessions in the same area include Bolivian Gulf Oil Company, Shell Prospecting Company, Andes Oil Company, Inc. (Pure, et. al.), and Chaco Petroleum, the last named having been organized jointly by Tennessee Gas Transmission, Union Oil & Gas of Louisiana, Lion Oil, and Murphy Corporation, for the purpose of acquiring properties formerly operated by the Glenn H. McCarthy interests.

Over a period of years extensive geological and geophysical studies have been carried on by various companies, including the government agency, YPFB, in this wide belt along the east flank of the Andes Mountains in eastern Bolivia, extending for more than 300 miles northward from the Argentine border. To date more than 100 structures have been mapped. Testing of 33 of these, by no means adequate or conclusive, has resulted in the discovery of 11 oil fields, four of which are being actively operated by YPFB. Production therefrom of approximately 10,000 bbl per day is restricted by local demand and limited exports of crude and products to neighboring countries, which constitute the only present market.

It is reported that one or more of the American companies holding concessions in this area of Bolivia, having completed preliminary geological investigations, plan to initiate exploratory drilling in the immediate future.



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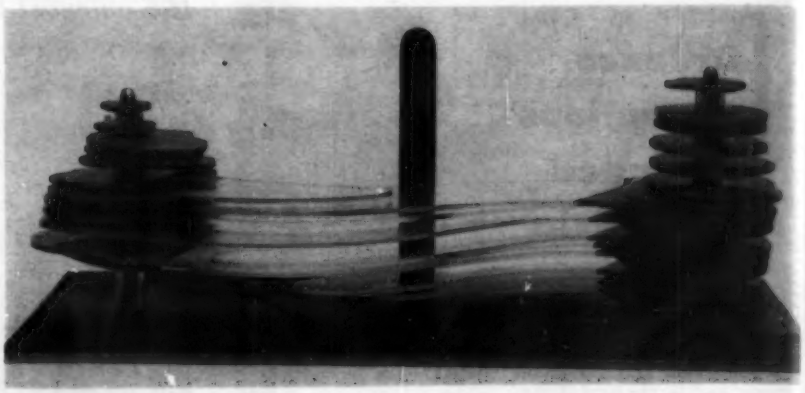


FIG. 1. **Model of two brine wells** in Canada located 300 ft apart and connected by a tunnel. Opaque areas show the shapes of the cavities as revealed by the sonar caliper surveys; clear plastic represents approximated shape of the connecting tunnel.

New Use of Sound Wave Reflections

Sonar Caliper Simplifies LPG Storage Surveys

Volume and shape of salt storage caverns determined accurately enabling construction of scale models

J. P. Chisholm and G. D. Patterson,
Dowell Incorporated, Tulsa, Oklahoma

SURVEYING UNDERGROUND CAVERNS for LPG storage has been simplified by the use of a recently-developed sonar caliper. This instrument surveys cross sections of such cavities at various depths by measuring the time required for directional sound-impulse beams to travel from a down-hole transmitter to the cavern wall and back. From these cross sections the storage well's volume is calculated. Advantages of this instrument include great accuracy, rapid operation, and a simple data-recording device.

Companies that store LPG in salt formation cavities need to know the size and shape of such cavities for several reasons. While a salt well is being leached, it is important to know the cavity's shape (which affects its roof strength) and the direction in which the cavity extends.[1] Such cavities should, of course, remain within the operator's property and should not undermine buildings. Naturally, it is important to know the storage capacity of a salt cavity, just as it is to know the capacity of any other storage facility.

Caliper Operation

The sonar caliper consists of a down-hole tool and a wire line truck containing the operating and recording mechanisms. The down-hole tool (Fig. 2) rotates continuously while transmitting intermittent sound pulses. As these sound signals echo from cavern walls they are recorded on the face of a cathode tube in the wire line truck. (Fig. 3.) The cathode tube also records a directional signal transmitted by the rotating down-hole tool each time it passes magnetic north.

The cathode ray tube can record on any of five different range scales, indicating radii from 0 to 25, 50, 100, 250, or 500 ft. The signals are recorded by Polaroid photography, giving the full outline of the cavity at each step. (Fig. 4.) Each photograph can be oriented directionally by means of the magnetic north signal appearing on the face of the cathode ray tube. This combination of camera and radar-type cathode tube gives records of distance versus azimuth immediately, without plotting data by hand, thus minimizing the time required to calculate the area of cavity cross sections.

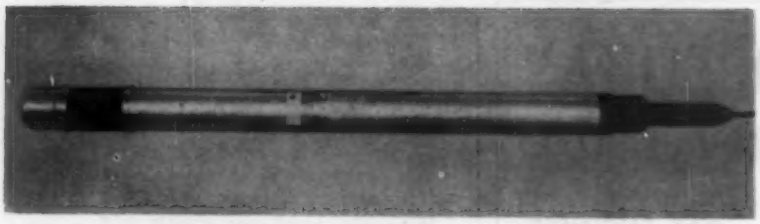
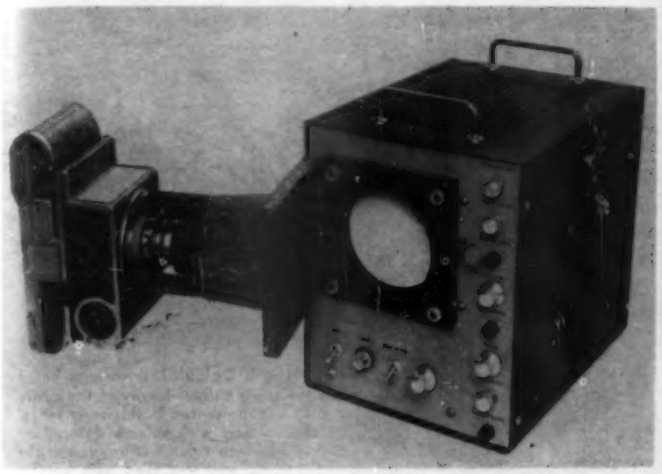


FIG. 2. **Down-hole tool** generates directed sound waves which are reflected from the cavern wall and detected by the tool.

FIG. 3. **Cathode tube** records echoes transmitted from the down-hole tool. Camera photographs the pattern created through a complete revolution of the tool.



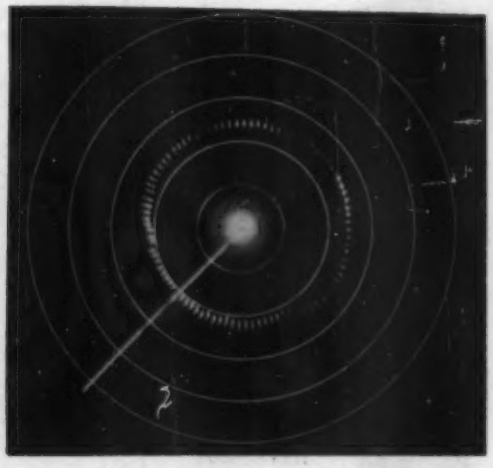


FIG. 4. **Photograph of the signals** received on the cathode tube, outlining the cavity at the recording depth. The long white line radiating from the center of the tube marks the passage of the signal through magnetic north.

The sonar caliper's minimum range in salt water is 1½ ft. Tests show that its maximum range is more than 500 ft in clean, non-gaseous water. The instrument's accuracy is plus or minus 5 percent, although with special care, its accuracy has frequently been kept within about 2 percent.

Survey Procedure

The first step in surveying salt cavities with the sonar caliper is to run a bailer into the well to take fluid samples at various depths. Usually from one to three samples are taken, depending upon the length of the zone to be surveyed. From these samples, the speed of sound in the well fluid can be calculated.

The down-hole sonar tool is then run into the hole, and cross-sectional surveys are made at regular intervals of from 5 to 20 ft, depending upon the shape and depth of the cavity being surveyed. Photographs of the cavity's cross section, as shown on the cathode tube, are taken at each depth surveyed.

These photographs are enlarged by projection to a scale of 1 in. equals 20 ft, and the area of each cross section is determined with a planimeter. This cross-sectional area, converted into square feet, is used to determine the cavity's volume.

Data Presentation

Data from the sonar caliper survey is presented in four ways. First, a cross-section data sheet is prepared, giving the radial distance from the center of the well bore to the cavity walls, for each depth surveyed, and in the eight major directions from the center point. Second, a separate table gives volume calculations and the areal data from which they were prepared. This table includes the cavity's accumulative volume (in barrels) from the top of the surveyed area to total depth. The third type of data presentation is in the form of cross-sectional profiles, drawn to scale on graph paper, along each of the four major directional axes. The fourth type of data presentation is in the form of a scale model of the cavity.

These models are carefully constructed to scale from the cross-sectional data obtained by the survey. They illustrate clearly the well's shape and size.

Some of the advantages of the sonar caliper survey are illustrated by these models. For example, Fig. 5 shows a model of a cavity having long, narrow cross sections. Many cavity survey methods would probably have missed the long tips of these cross sections, thus resulting in inaccurate volume calculations.

Field Results

The scale model shown in Fig. 6 illustrates results of a survey which proved the sonar caliper's accuracy. An interface volume survey had also been run down the hole as the well was filled with butane.

Results of these surveys showed that the volumes determined from the sonar caliper survey were very close to the interface survey volumes at all degrees of filling. In addition, the scale model visually illustrated how and in which directions washing operations were proceeding.

Two brine wells surveyed in Canada provided interesting results. The wells were 300 ft apart, and were connected by a tunnel. Fig. 1 shows a model of these cavities as revealed by the surveys. Opaque areas show the shapes of the cavities, as shown by the survey.

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The tunnel's size was calculated from the total amount of salt removed from the wells, less the surveyed volume of the wells. Actual shape of the connecting tunnel was, of course, approximated. Evidence indicates that it is reasonably accurate, however.

In the Gulf Coast area, a brine well that had partially caved in above the lower end of the cemented casing was surveyed. When the caved portion was revealed by the survey, a 25-ft section was cut from the lower end of the pipe. The sonar caliper was re-run in the hole, and the survey showed that a considerable caved-in area still extended above the bottom of the pipe. Another 25-ft length of pipe was then cut off. This time the sonar caliper showed that the cavity extended only slightly above the lower edge of the cemented casing.

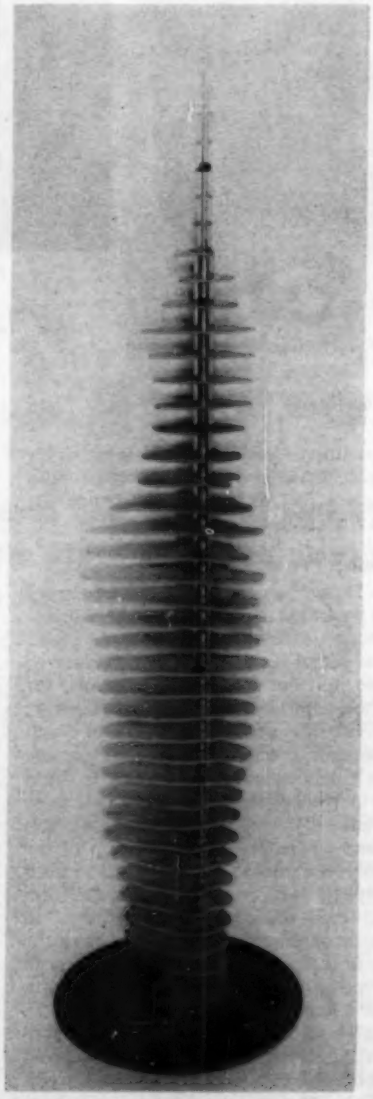

FIG. 5. Model of a cavity having long, narrow cross sections. The long tips of such cavities are usually difficult to survey.

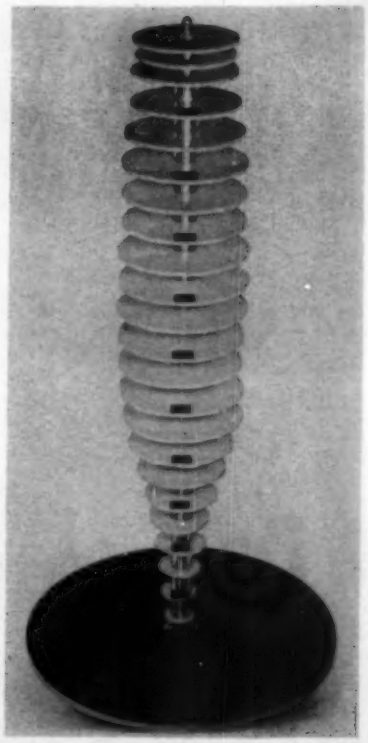

FIG. 6. Calculated volume based on the sonar caliper survey of the cavity represented in this scale model checked closely with volume determined in interface volume survey run as the well was filled with butane.

With this information, the operator was able to spot a light hydrocarbon around the cemented pipe in order to prevent further washing or caving. If the survey had not been run, in all likelihood washing out and caving of the cavity would have continued, possibly resulting in serious damage to the well.

Two other wells provided another interesting check on the accuracy of volume determinations based on sonar caliper surveys. This operator had leached both wells at the same time, assuming that the same water flow was entering each. The sonar caliper survey showed that one cavity was smaller and one larger than the operator had expected. The total volumes of the two, however, checked with the total calculated volume of salt removed. Upon testing, it was found that the well flow meters were not accurate, and that more water had actually entered one well than the other.

Reference

1. Jahns, D. F. "Formation Strength In Salt Cavern Storage," *The Petroleum Engineer*, August 1957, p. B-96.

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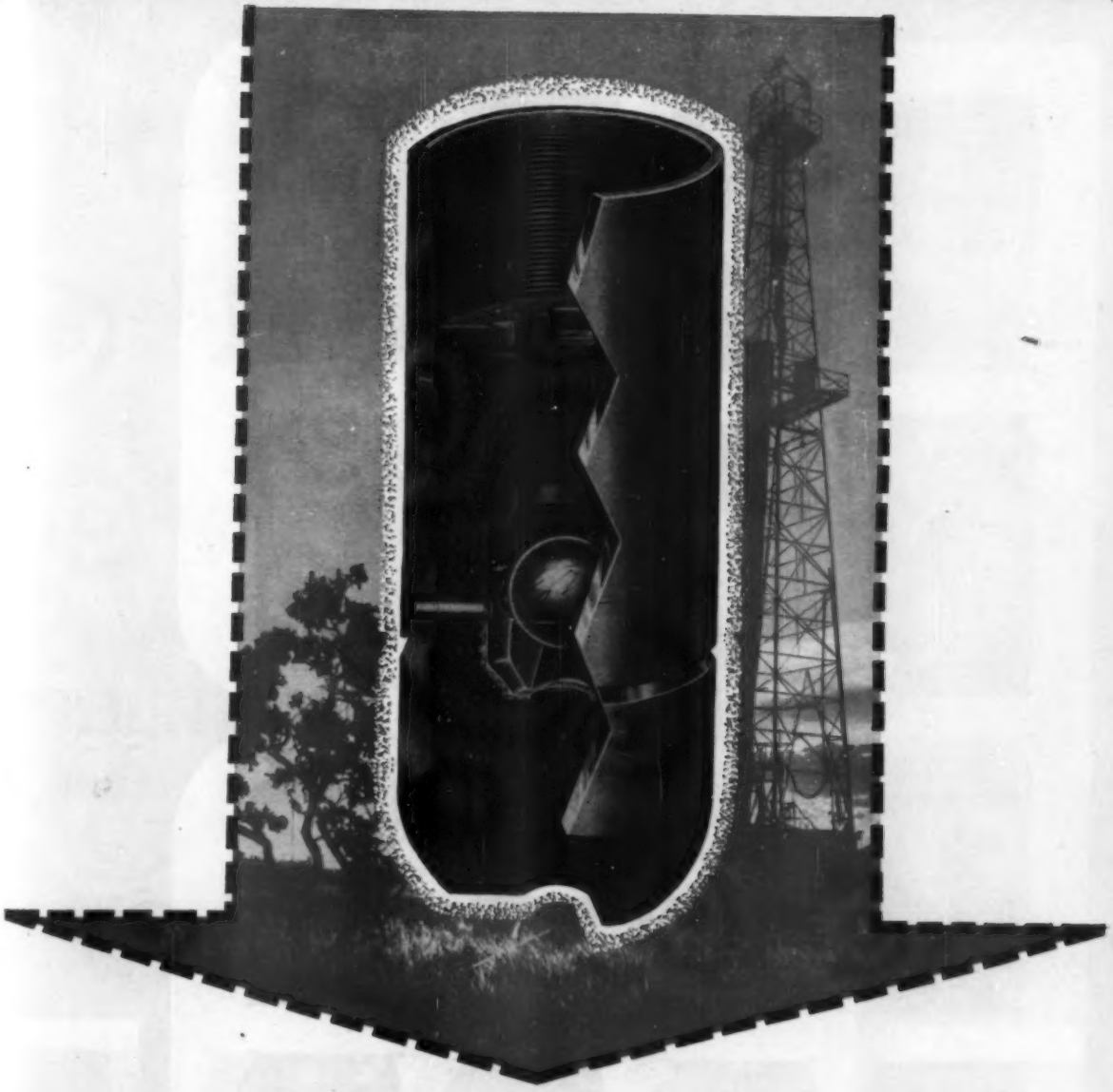

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Dowell Celebrates 25th Anniversary

This winter, Dowell Incorporated marks its silver anniversary.

In the 25 years since the first successful acidizing of an oil well in Michigan, there have been many changes in equipment, techniques and materials. Basically, Dowell engineers are still doing now what they were doing when the company began — finding new methods and materials that will help to recover oil and gas.

The science of well stimulation has been of great help in keeping reserves and production in pace with demand. Not only do the services provided help to improve newly completed wells, but a large number of materials and techniques are available for the rejuvenation of old producers. Along with the development of various services, there has also been the development of a number of chemicals and techniques that are used widely in secondary recovery operations. Dowell has a family of more than 50 different services to aid the oil industry.

The company is active in another important activity — that of the use of chemical methods in industrial plants for the rapid and efficient cleaning of process equipment. Oil field and industrial work is done from over 170 Dowell locations in the United States, Canada, and Latin America.

More Aluminum Lines For Venezuela

Superior Oil Company of Venezuela has announced plans to install a system of aluminum underwater flow lines in Lake Maracaibo. Eight thousand feet of 5-in. Schedule 40 aluminum pipe will be laid.

Superior is the second company to order aluminum underwater flow lines for use in Lake Maracaibo. Creole Petroleum Corporation recently announced plans for 22-mile system of underwater aluminum lines, including a three-mile section of 8-in. pipe.

Coated and wrapped steel pipe has been used exclusively for flow lines in the past. Corrosion problems with steel in the Venezuelan lake have led to these initial uses of aluminum pipe, which is not adversely affected by the lake's chemical properties.

The world's first aluminum-jacket offshore drilling platform recently was erected for Superior in Lake Maracaibo.

$11,100,000 Bonus Wraps Up California Offshore Drilling Deal

A contract providing a bonus of $11,100,000 for the right to drill for offshore oil was signed early in December by Shell and Continental Oil companies and the City Council of Hermosa Beach, California.

The contract gives the oil companies the right to drill in the city's submerged lands and the use of a tract of city property for operational headquarters and separation center.

Hermosa Beach, located on the southern California coast, is one of nearly 100 California cities acting as trustee for submerged lands.

According to the contract, all drilling must be done at sea from four drilling platforms, with all but one of the platforms to be located at least one mile from shore. One platform may be located at the three-quarter mile mark at the southern boundary of the offshore tract. The contract contains stringent anti-pollution and nuisance clauses.

Offshore lands owned by the adjacent city of Redondo Beach are presently being developed by slant drilling from the Redondo shore.

In consideration for signing the contract, Shell and Continental officials presented the council with a $500,000 check. Balance of the bonus will be paid if the city's voters approve an oil drilling ordinance at a February 25 special election.

Shell and Continental outbid three other oil groups last April when the Hermosa Beach governing body asked for oil development proposals. The companies and city officials have been negotiating the contract since last June.

Annual Index for 1957
The Petroleum Engineer

The editorial index of articles published in all editions of *The Petroleum Engineer* during 1957 is now available.

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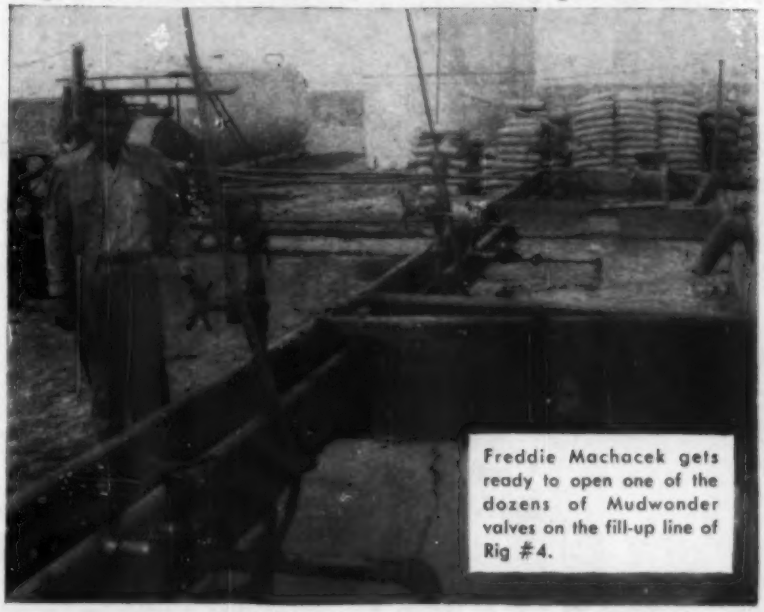
Please state company position and don't forget to include your address.

Tips on Mud Valves for Toolpushers . .



Freddie Machacek gets ready to open one of the dozens of Mudwonder valves on the fill-up line of Rig #4.

MUDWONDER Ideal for Versatile Service

by Freddie Machacek, Toolpusher, Rig #4
B.B.M. Drilling Company, Midland, Texas

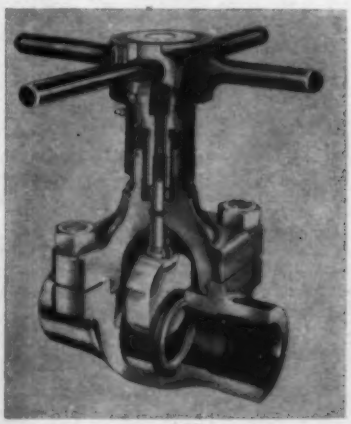
ABOUT two years ago I put a *Mudwonder* valve on our fill-up line just to see how it would make out. I soon found that *Mudwonder* worked fast and easily, without binding, even while bleeding off the line at 1600 lbs pressure. It did so well I tried more *Mudwonders* on the tough job of mud pit service—and they were so successful I've standardized on *Mudwonder* ever since!

Valves on mud guns and jets take a terrific beating, but we've had very little trouble with *Mudwonders*. As a matter of fact, our first ones are still in service; we replaced the stem packing on one valve—that's all! Because replacement parts are so easy to identify, we never have any trouble getting the exact part we need. In fact, the valves are designed to use the same seat and gate for both pressure classes.

When we have to dress a *Mudwonder*, the job can be done without disturbing any connections. The valve is out of service only about 10 minutes, start to finish, regardless of size. Another thing—they never sand up. Bob Lawrence, Edward *Mudwonder* Representative, says this is because the design causes the mud to flush the bonnet automatically.

Mudwonder valves are available in 2", 3" and 4" sizes; with screwed or flanged ends; rated at 2000 psi WP (4000 psi test) and 3000 psi WP (6000 psi test). See your favorite oil field supply store for complete information, or write Edward Valves, Inc., East Chicago, Indiana, subsidiary of Rockwell Manufacturing Company.

Mudwonder cut-away view shows the one-piece seat insert, with Buna-N molded integrally over steel wear rings; chromed gate with "T" slot connection; separated stainless stem and double thread construction.



FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

Some Late Additions to the . . .

OFFSHORE DRILLING FLEET

Coastal-Marine Adds Self-Propelled Tender

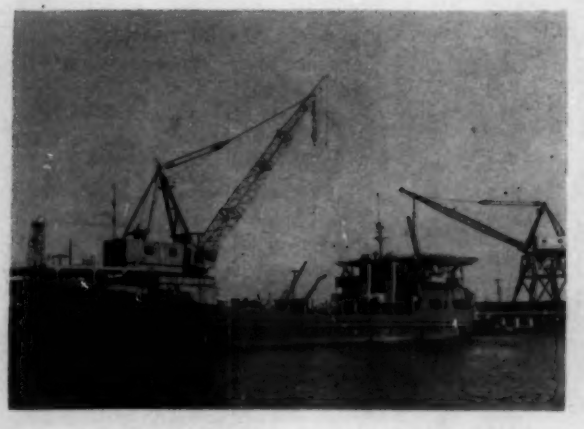
A NEW TYPE of offshore drilling tender, the most powerful to operate in the Gulf of Mexico, was introduced to the industry in Beaumont, Texas, on October 30, when the 3150-ton "Howard S. Cole, Jr." was commissioned by Coastal-Marine Drilling & Construction Corporation of Houston. The self-propelled tender is also the first vessel of its type to feature dual-purpose main power units, designed to be used for both drilling and ship's propulsion.

Self-Propelled Tender

The 272-ft platform tender has a 56-ft beam and a 17-ft loaded draft. Hull is sub-divided by watertight bulkheads, forming a forepeak tank, cement and mud storage compartments, dry chemical stores, drilling water tanks, fuel oil tanks, engine and pump rooms, fresh water tanks, and a steering gear room.

The second deck is given over to general storage. Also located in this area is a completely equipped machine shop and an electrical workshop. Located aft are completely air-conditioned living quarters for 58 persons. Included in the living quarters are two offices, a central radio room, a recreation room, a well-equipped sick bay, lounges, officers' and crews' messrooms and a completely equipped galley.

Power plant. The main engine room on the tender houses five differential compound traction type d-c generators, each driven by a turbocharged diesel engine having a continuous rating of 500 hp at 1200 rpm. This d-c power plant supplies power for the operation of the drilling rig equipment, propulsion motors and the 60-ton deck-mounted crane. Also installed in the main engine room are two 350-kw, 438-kva, 240/480-v a-c generator sets, each powered by a 500-hp turbocharged diesel engine. One a-c generator set has adequate capacity to supply all of the a-c power requirements of the drilling tender and auxiliary rig equipment.



Mud pumps. In the bow of the drilling tender are two 7¾ in. by 18 in., 1200-hp main mud discharge pumps driven by two d-c electric motors and capable of delivering 880 gal per min at 65 strokes per min. Each pump has a maximum operating pressure of 4300 psi with minimum-size liners.

Storage Capacity. Storage capacities are 5000 sacks of bulk mud, 1800 bbl of liquid mud, 2500 sacks of bulk cement, 12,500 bbl of drilling water and 500 bbl of drinking water.

Cargo and Service Vessel

Also commissioned at the Beaumont ceremonies was the company's service vessel, the "Irwin W. Alcorn." This vessel's overall length is 132 ft with a 35-ft beam and a loaded draft of 9 ft. It has a loaded cargo capacity of 605 tons, made possible through the use of 6 cargo tanks with a combined capacity of 3300 bbl for fuel oil and fresh water. The large deck is especially reinforced to accommodate 10,000 ft of 9⅝-in. casing.

Drilling Platform and Equipment

The third component of the new drilling team is the drilling equipment which is mounted on a stationary platform and rated to drill in excess of 20,000 ft. The drawworks is a double drum, air-controlled unit with 4 speeds forward and 4 reverse. The derrick has a 1,100,000-lb load-carrying capacity and is designed to withstand 125-mph wind loads. On the substructure is mounted a combination cat works and rotary drive unit which is powered by a 600-hp traction type d-c motor, deriving current from the powering generators on the tender. The derrick's 560-ton crown block contains seven 55-in. sheaves, one 12 in. catline and one 20-in. sandline sheave. Traveling block is a 400-ton 6-sheave model, and the swivel is a 300-ton tandem main bearing type.

An emergency stand-by pump and generator unit is provided on the platform to be used if the tender is forced to pull away from the platform under emergency conditions.

The vessels and equipment will remain at the Port of Beaumont until completely fitted out and will then see service in the Gulf of Mexico.

BAASH-ROSS BANTAM SLIPS

THE NEW BAASH-ROSS TYPE "G" BANTAM SLIPS ARE AN OUTSTANDING ACHIEVEMENT IN DESIGN, ENGINEERING AND PRODUCTION.

Weighing ⅓ less than old types, they help keep rotaries "turning to the right" with maximum efficiency by reducing crew fatigue to a minimum. The lightest slips in the field (only 96 lbs. for the 4½" size) they still maintain traditional Baash-Ross quality. Patented grooved slip-back construction will permit slips being used without back-up tongs. Available in three body sizes—2⅞", 4½" and 5½" for all rotary tables. Liner segments cover the full range of sizes from 2-1/16" to 5½"; liners may be inverted to balance wear.

OTHER ADVANTAGES • 7500 ft. (approx) 4½" drill pipe • Properly engineered gripping surface • Release easily • Easy liner segment replacement • Long liner wear

Write for details on all types of slips or see the Composite Catalog.

BAASH-ROSS *Tool Company*

DIVISION OF JOY MANUFACTURING COMPANY

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FOREIGN OFFICES:
New York, N. Y.; Greenock, Scotland; London, England; Paris, France; Maracaibo, Venezuela; Buenos Aires, Argentina.

Loffland Bros. Drills in Venezuela's Gulf of Paria

The first wildcat in a new concession area of Venezuela's Gulf of Paria was scheduled to be spudded by October 15.

The drilling tender "Orville Fisher," owned by Loffland Bros. Company, moved out of Orange, Texas, early in September in order to get set up on the first of four locations to be drilled by the company.

The new concession area, covering nearly 150,000 acres, lies some 10 or 11 miles from offshore production near the British island of Trinidad. The concession is held by five companies, with Continental Oil Company as operator.

The new Loffland tender is named for Orville Fisher, southern regional vice president for Continental. It is similar to four other Continental tenders operating in the Gulf of Mexico.

Loffland plans to have 15 men aboard the tender permanently, which will be supplied from Loffland's Anaco yard and camp, their headquarters for eastern Venezuela drilling. Operating base for the four wells to be drilled by Loffland will be located on the tender for the time being.

The valuable concession area in the Gulf of Paria cost the five-company combine $100 million.

Rimrock Tidelands Plans Submersible Drilling Barge

Rimrock Tidelands, Inc., has awarded the construction contract for its first submersible drilling barge to Southern Shipbuilding Corporation of Slidell, Louisiana.

A John Hayward type, the barge is designed for drilling in water depths of from 12 to 35 ft. It is scheduled for launching in March 1958.

Measuring 192 ft long, 140 ft wide and 10 ft deep, the barge will be supported by four pontoons fabricated as integral parts of the hull. The pontoons may be removed without drydocking—reducing the barge to a 60-ft width for passage through narrow channels.

Capable of drilling to 20,000 ft the barge drawworks will be one of the largest powered by diesel engines, totaling 1500 hp. Other rig components will include two 1000 hp mud pumps and 142-ft million-pound capacity mast. Drilling slot will measure 20 ft by 32 ft.

Air-conditioned crew quarters located above the machinery level will feature sound-proof floors, an innovation in drilling barge construction. Accommodating 40 men, the quarters will be built in three and six-bed units. Adjoining the toolpusher's suite will be quarters for the drilling superintendent and guests and an operations office. The crew will have a recreation hall, with television and library.

The drilling barge will become the fifth Rimrock rig operating offshore when it is commissioned. Two Rimrock rigs are already drilling on stationary platforms under contract for Sinclair Oil & Gas Company, and two additional deep drilling rigs will be located on other Sinclair offshore platforms this fall. A sixth Rimrock offshore rig will be mounted on an offshore barge now being built for Union Producing Company, with whom Rimrock holds an eight-year drilling operations contract.

Before delivery to Rimrock, the barge and rig will undergo a shakedown cruise under similated drilling conditions in 30 ft of water.

Webster Drilling Company Christens "Mr. Luke"

Webster Drilling Company of Houston, Texas, has recently christened its new submersible drilling barge, "Mr. Luke." The unit was built by the Levingston Shipbuilding Company and was named in honor of Luke Halpain, general superintendent for Webster. Immediately following dedicatory ceremonies, the barge left for its first drilling assignment south of New Orleans.

"Mr. Luke" is the first vessel of this type to operate for the Webster Drilling Company. The barge is designed and equipped to drill in the 16,000-ft range. It is a slotted-type vessel, 180 ft long, 48 ft wide and 12 ft deep.

Personnel aboard the "Mr. Luke" will have air conditioned quarters with up-to-date galley and working facilities provided for operation in remote swamp locations. ✱ ✱

Atlantic Completes Gasoline Plant In West Texas

Atlantic Refining Company has announced completion of a new 104,000 gal per day gasoline plant at Block 31 field, Crane County, West Texas.

The new plant, operated by Atlantic and jointly owned with Continental Oil Company, Champlin Oil and Refining Company, and Phillips Petroleum Company, is now processing 23,000,000 cu ft of gas per day which is obtained principally from production at the Block 31 field. The daily volumes of liquefied petroleum products extracted from the gas are 48,000 gal of propane, 36,000 gal of butane, and 20,000 gal of 12 lb gasoline.

The plant was constructed by the Delta Engineering Company of Houston, Texas, working under Atlantic's engineering and construction department.

In 1949 Atlantic and its co-owners initiated the first high-pressure maintenance project in the U. S. at the Block 31 field. Gas produced from the field, plus purchased gas, is returned under high pressure to the Devonian reservoir. Purpose of the program is to sweep the reservoir and produce a much higher percentage of the original crude oil reserves. The new gasoline plant now extracts the liquid products from the gas before its return to the reservoir.

Seismic Group Returns to Africa

New seismic operations in North Africa will find SSC better equipped by the purchase of five air conditioned mobile units to serve its crews.

The mobile units will provide air conditioned crew kitchen, machine shop, dining quarters, and office for the crew, which will operate out of Tripoli, the Libyan capital.

SSC and its subsidiaries have done extensive work in Africa. The company recently announced that four crews of Compagnie Francaise de Prospection Sismique, the French subsidiary, are working in the Sahara desert.

Area manager for the Libyan operation will be W. W. Green, with C. E. Warnaca as party chief.

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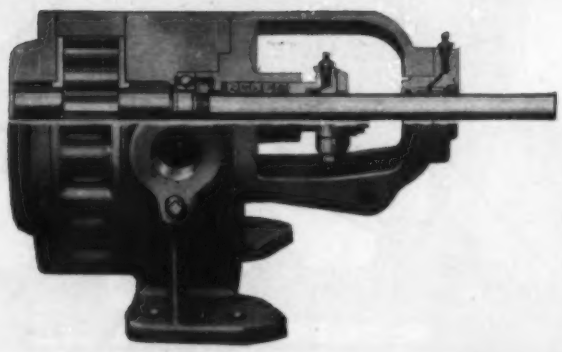

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FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

First Fracturing Barge Launched

The world's first oil well fracturing barge soon will go into service on Venezuela's Lake Maracaibo.

The 130-ft steel "Halliburton 808" is the first fracturing unit built for water locations. It will be used by Cia. Halliburton de Cementacion y Fomento, the Venezuelan subsidiary of Halliburton Oil Well Cementing Company. The barge was built in New Orleans and towed across the Gulf of Mexico to South America.

Fracturing on Maracaibo Basin wells was first applied in 1954 by Halliburton. Since then more than 200 wells have been treated and producers have indicated stepped-up fracturing programs for water locations. So far the lake wells have been fractured with trucks carried on barges.

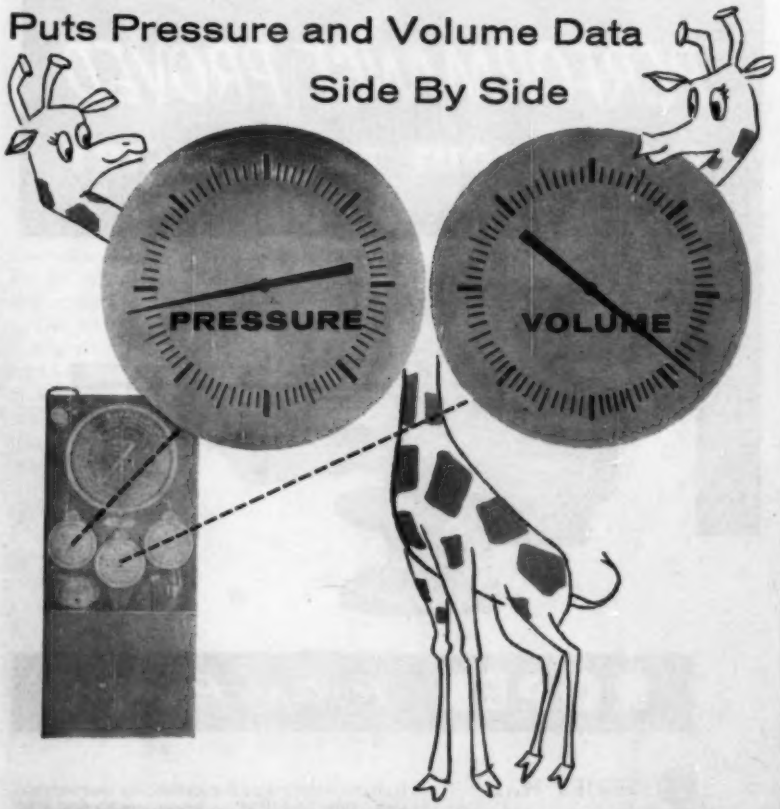
"Both the barge and its equipment were designed for the unusual assignment of fracturing wells at water locations," said Ralph R. Emery, Halliburton's vice president for foreign operations. "Based on an average 1500-sack fracturing job, the "808" will do the work of two fracturing trailers, a sand proportioner truck, six sand transports and probably a dozen oil transports that would be required for a comparable fracturing job on land. In addition, the "808" can perform at least two such fracturing treatments before returning to base."

Fracturing equipment aboard the "808" includes four T-10 pumps, each powered by a 600-hp diesel engine; a sand proportioner for mixing fracturing fluids and sand, and a chemical agitator. All fracturing equipment, control consoles and storage for sand and chemicals are located on deck.

Below deck the barge has storage for fracturing fluids, fresh water and diesel fuel. It carries 4000 bbl of fracturing fluid, 3850 sacks of sand, 15,800 gal of diesel fuel and 6000 gal of fresh water. Air conditioned living quarters and galley are provided in a deckhouse.

The barge was built by Higgins, Inc., at its New Orleans shipyard. Fracturing and most auxiliary equipment for the "808" was shipped from Halliburton's Duncan, Oklahoma, manufacturing plants and mounted on the barge at the service company's Harvey Canal docks across the Mississippi River from New Orleans.

It Takes Two – Only MARTIN-DECKER Puts Pressure and Volume Data Side By Side



MARTIN-DECKER Combination Pressure Gauges and Volume Indicators Tell the Complete Hydraulic Story

Two gauges are necessary, but two heads are not. Mud Pressure by itself does not tell the whole story. Both pressure and volume are needed. A pressure drop indicates trouble but is it a clue to a cut-out bit or tool joint, or is it a pump slowing down?

Hydraulics are becoming the most important single factor in drilling wells. The driller must know what his pumps are doing in order to protect his equipment, follow his hydraulic program and quickly note any troubles so that prompt action can prevent serious damage. Only with both pressure and volume information can you know the complete story of your hydraulic system.

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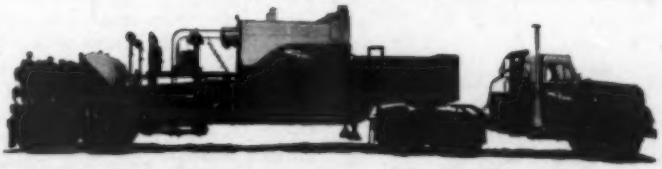
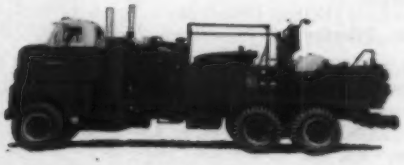
THESE HALLIBURTON TRUCKS mean more efficient fracturing



TWIN T-10, FRACTURING LO-BOY

MODEL 45, SAND PROPORTIONER



TWIN T-10

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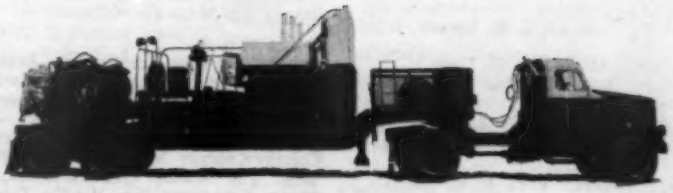

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Caracas: % Petroleum Industry Consultants, P. O. Box: Apartado Postal 3992. Telephone: Anaco, Venezuela 337 (Servicentro Esso). William E. Baham, district manager; B. C. Bagwell, field representative; R. E. Morrison, field representative, Anaco, Venezuela.

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Puerto La Cruz: Klm. 4 — Carretera Blanca. P. O. Box: Apartado 4152. Telephone: 1129. Luigi Límido, manager.

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Barinas: Av. 2 de Diciembre No. 128. Humberto G. Anderson, manager.

Maracaibo: Av. Los Haticos 117-24. Telephone: 6665. Richard H. Miles, manager; Luís Rosillón, assistant manager.

Carl E. Reistle, Jr. Receives Lucas Gold Medal, Major AIME Award

Carl E. Reistle Jr., of Houston, Texas, executive vice president of Humble Oil & Refining Company, has been named by the American Institute of Mining, Metallurgical, and Petroleum Engineers to receive the Anthony F. Lucas Gold Medal, a major award of the Institute and an outstanding honor in petroleum engineering.

Reistle, a former president of AIME and the author of many important technical papers, will receive the award the evening of February 19, 1958, at the annual banquet of AIME in New York.

The citation states that Reistle was named "for his distinguished achievements in advancing the science of petroleum engineering through his own technical contributions and his ability to inspire others; for his forward concepts and his untiring energy in advancing the profession of petroleum engineering as a practitioner, administrator, and executive."

Reistle was born in Denver. He was graduated in 1922 from the University of Oklahoma with the degree of BS in chemical engineering. After graduation Reistle joined the U. S. Bureau of Mines in Bartlesville, Oklahoma, as a junior petroleum chemist. While with the Bureau he worked in many major oil fields. During this time he published a number of articles on oilfield brines, paraffin problems in the production of crude oil, and the operation of flowing wells.

Reistle left the Bureau in 1933 to become chairman of the East Texas Engineering Association, a cooperative organization formed to obtain engineering facts on the efficient operation of the East Texas field. His efforts had an important part in establishing efficient production rates and practices for the field.

In 1936, Reistle joined Humble as engineer in charge of the petroleum engineering division and several years later was advanced to the head of the division. In 1945 he was named general superintendent of the production department and in the same year he became manager of production operations. Reistle was elected to the board of directors of the company in 1948. He was elected vice president in 1955 and executive vice president in 1957.

During World War II, Reistle was technical advisor for District 3 of the Petroleum Administration for War. He was also national vice chairman of the Oil Industry Advisory Committee for the Office of Price Administration. Reistle was president in 1956 of the AIME. He is a member of the American Petroleum Institute and a member of the board of directors of the Fifth World Petroleum Congress to be held in New York in 1959.

Through some fifteen published technical papers and many articles, Reistle has been a continuing contributor to engineering literature. He holds patents on a number of technical tools and processes. He is active in civic affairs.

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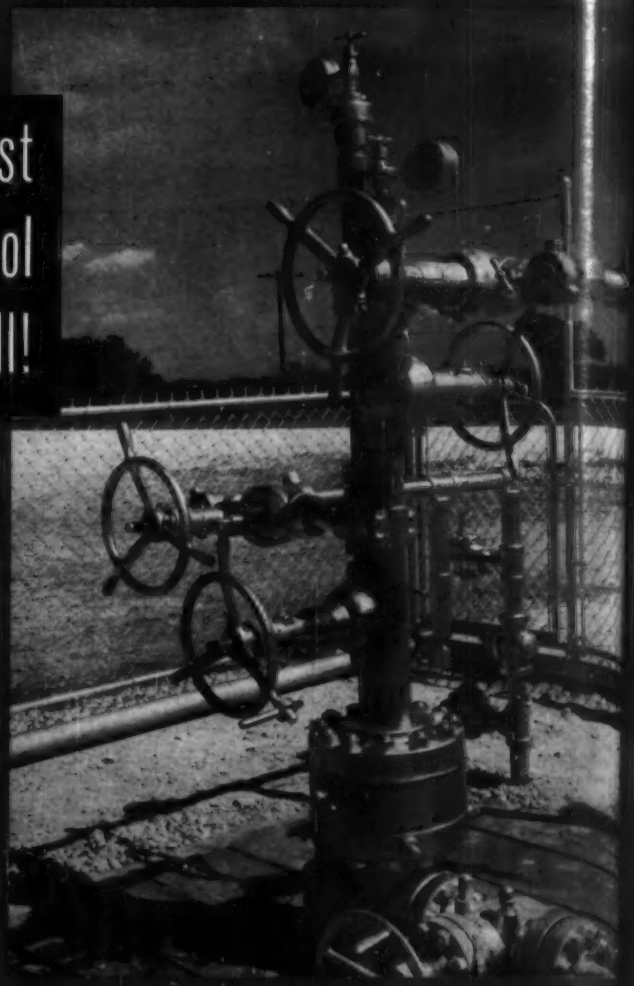

ORBIT forged steel SCREW END VALVES

The compact design and full round opening feature of Orbit forged steel production valves makes the screw end type readily adaptable to dual string surface control. By using ORBIT SCREW END VALVES with the recessed body to permit perfect tubing alignment, a tremendous savings can be realized over other types of valving for dual completions. Orbit forged steel valves are built for continuous heavy-duty production service, they always operate easy and shut off when called upon to do so. A pliable plastic packing with a shredded base of "Teflon"*, that is easily extruded, is provided as a stem packing in all Orbit forged steel valves. This packing can be adjusted if necessary while the valve is in service and under pressure.

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OU Completes Research of Flow Through Porous Media

Getting more oil out of the ground is the long-term aim of a research project recently completed at the University of Oklahoma.

An investigation of how fluids make their way through porous materials, it falls in the basic research category. The study, financed by the American Petroleum Institute, was started in 1949.

The final report has been published for sale throughout the oil industry. It's a valuable study of an important subject, which is likely to find extensive application in the future, according to Dr. Alfred Chatenever, project supervisor.

It has given new ideas of what happens to water, oil, and gas in a reservoir system. Chatenever hopes this information will lead to improved recoveries.

"We have been leaving more than 50 percent of our reserves in the ground," Chatenever said. "We are interested in producing future fields so we don't leave that much behind."

The OU project was "probably the first to put out in a visual form the behavior of reservoir fluids," he said. The report reproduces a number of color photomicrographs, and a film previously produced at OU as part of the project has received world-wide circulation.

Studies were carried out by pumping fluids at various flow rates through two types of observation cells. One type of cell utilized a single layer of uniform glass spheres; the other had a flow bed of natural reservoir rock, sliced thin enough to look through.

Annual Index for 1957
The Petroleum Engineer

The editorial index of articles published in all editions of *The Petroleum Engineer* during 1957 is now available.

Subscribers wishing to receive a free copy should write to this magazine, P. O. Box 1589, Dallas, Texas.

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Additional savings mount up in the use of the VOL-U-METER. For example, on an Oklahoma Lease one CV VOL-U-METER was used on a dual completion well and tied into a common tank eliminating the need for dual tankage on the dual well. The second welded tank, which would have been required, would have cost approximately $1,750.00, about *three times the actual cost of the VOL-U-METER.*

VOL-U-METERS are available in three types of vessels, the CV, FV and FVC (Type FV with cone-shaped bottom).

TYPE CV is barrel-shaped and utilizes one liquid level control pilot system.

Type FV features two liquid level control pilot systems with one in each of the reduced necks.

TYPE FVC features a cone-shaped metering chamber which is lined with plastic. It has a liquid level control pilot system in the upper reduced neck and one in the lower neck, as does the FV. The FVC is designed for use where foreign matter in well fluid will probably settle in the vessel reducing its metering accuracy.

The three types of VOL-U-METERS are available in dump volumes from ¼ barrel to 10 barrels, with capacities of 300 to 4,000 BPD, and working pressures from 125 psi to 1200 psi for the CV and to 2400 psi for the FV and FVC.

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Books To Read

Tatlock's Four Corners and Rocky Mountain Directory, *published by Tatlock's, 608 Majestic Building, Denver 2, Colorado. Price, $5.*

Directory lists some 9000 individuals and companies operating in the highly active Rocky Mountain and Four Corners region in oil and mining industries. All information is cross indexed and is bound in loose leaf form in convenient pocket size. Directory covers states comprising Rocky Mountain area. State and federal agencies associated with oil and mining are listed.

Quantitative Organic Analysis, *by James S. Fritz and George S. Hammond, published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, New York. Pages, 303. Price, $6.50.*

Primarily a classroom text, the authors stress importance of analysis of selective, functional group reactions. Numerous methods of analysis are described — direct and indirect acid-base techniques, oxidation-reduction methods, spectrophotometric analysis, analytical separations, kinetics, etc.

Heat and Thermodynamics, *by Mark W. Zemansky, published by McGraw-Hill Book Company, 330 West 42nd Street, New York 36, New York. Pages, 484. Price, $7.50.*

This intermediate textbook requires that the student have a course in general physics and one in calculus. First 10 chapters are devoted to fundamentals of thermodynamics, with examples of rigorous application provided. The remaining nine chapters deal with physical, chemical, and engineering applications in greater detail.

A Symposium of Oil and Gas Fields of Southeastern New Mexico, *published by the Roswell Geological Society, P.O. Box 6732, Roswell, New Mexico. Pages, 375. Price, $15.*

This is the first complete review of Southeastern New Mexico fields since the New Mexico Bureau of Mines and Resources published its Bulletin 18 in 1942. The new symposium reflects all the changes and growth in this area in the past 15 years. Included are structure sections, correlation charts, columnar sections, structure contour maps of 115 individual fields, and field data sheets for 215 fields.

Geologic Field Methods, *by Julian W. Low, published by Harper & Brothers, 49 East Thirty-third Street, New York 16, New York. Pages, 490. Price, $6 for professional edition, $4.50 for text edition.*

Pocket-sized and directed to solving actual field problems makes this book a good field companion for either the pebble-puppy or the experienced rockhound. The book is prepared by the research geologist for The California Company. Its many tables and formulas help the man in the field solve practical field problems. Some 200 illustrations pinpoint geologic relations commonly encountered in the field.

Centrifugal and Axial Flow Pumps, *Second edition, by A. J. Stepanoff, published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, New York. Pages, 402. Price, $12.*

Second edition of this volume has been expanded and revised to include the considerable progress in theoretical reasoning, design, and application of centrifugal pumps. Theoretical treatment of impeller action and casing performance and the method of presenting experimental information have been retained by the author. Major additions are: Water-hammer problems, thermal cavitation criterion to correlate cavitation data on the basis of axial and mixed flow pumps, new material on centrifugal-jet systems, a new viscosity chart, complete characteristics of axial and mixed flow pumps.

Occurrence of Oil and Gas in West Texas, *published by the Bureau of Economic Geology, The University of Texas, Austin, Texas. Pages, 112.*

This volume is the second in a series which was planned for presentation of data pertaining to the occurrence of oil and gas in Texas. The prior volume, "Occurrence of Oil and Gas in Northeast Texas" (publication 5116) includes treatment of every commercial occurrence of oil and/or gas discovered in the designated area prior to January 25, 1950.

It contains contributions by 104 authors. Approximate distribution of productive areas in the area is as of May 1, 1957.

Alberta Conservation Board Marks Importance of Drilling Regulations

The following are extracts from The Oil and Gas Conservation Act and the Drilling and Production Regulations which are of particular concern to drilling crews in the field. Cooperation in complying with these and any other applicable regulations is being solicited.

The Oil and Gas Conservation Act

Section 18. (1) No person shall commence to drill a well or undertake any operations preparatory or incidental to the drilling of a well or continue any drilling operations or any producing operations unless a license has been issued and is in full force and effect.

Section 31. (2) The duplicate of the license, together with the duplicate of any amendment thereof, shall be posted and kept prominently displayed at the well site during drilling operations.

Section 32. A license is subject to such conditions, restrictions and stipulations as may be set out therein or attached thereto.

Drilling and Production Regulations

Section 16. The operator of a well shall, at all times during which the well is being drilled, tested, completed or reconditioned, maintain the casing and control equipment in such condition that any oil, gas or water encountered shall be effectively controlled.

Section 39. (1) (a) The operator of a well shall make or cause to be made during drilling unless otherwise directed by the Board, tests from the top to the bottom of the well, at intervals not exceeding 500 ft or at such lesser intervals as the Board may require and at such frequency that drilling does not continue beyond 1000-ft intervals without the tests required in the 1000 ft being made, for the purpose of ascertaining to what extent, if any, the well deviates from the vertical.

Section 43. (2) No open element electric heater or flame-type stove, heater, treater or other flame-type equipment shall be placed or remain within 75 ft, shell to shell, of any well, separator, crude oil storage tank or other unprotected source of ignitible vapors.

Section 43. (5) No boiler or steam generating equipment shall be placed or remain within 150 ft of any well.

Section 43. (14) Exhaust pipes from internal combustion engines located within 75 ft of any well, separator, crude oil storage tank or other unprotected source of ignitible vapors shall be either insulated or sufficiently cooled to prevent ignition of flammable material.

Section 44. (1) Every person is prohibited from smoking on any rig or derrick or within 75 ft of any well, separator, crude oil storage tank or other unprotected source of ignitible vapors.

Section 48. (1) The operator of a well which is being drilled, tested, completed or reconditioned shall at all times maintain casing and blowout prevention equipment that are adequate having regard to the depth to be drilled, the expected pressures and the necessity in the case of a blowout of obtaining a shut-off on open hole or around the drill pipe, casing, tubing or any equipment being employed in the well.

(2) The assembly shall contain two valved lines below the blowout preventer for the purpose of bleeding off fluids and killing the well, if necessary, and the bleed-off line shall be installed and tied down; provided, however, that where prevention equipment in addition to that required by subsection (1) is installed, it may be below such lines.

(3) Controls for the blowout preventers shall be located outside the rig substructure.

(4) Prior to drilling out the surface casing or an intermediate casing, the blowout prevention equipment shall be pressure tested to at least 1000 lb per sq in., and the drilling out shall not proceed until the blowout prevention equipment, upon test, is found serviceable.

(5) While a well is being drilled, blowout prevention equipment shall be mechanically tested at least once each day and if found defective shall be made serviceable before drilling is resumed.

(6) All pressure tests and mechanical tests shall be reported on the daily drilling log book with full particulars including pressure, time and results.

Section 48. (7) During winter operations, the operator shall employ such methods as are necessary to ensure that the serviceability of blowout prevention equipment shall not be reduced through freezing.

(8) The Board may prescribe types of blowout prevention equipment that will be deemed adequate and may stipulate the condition under which any such equipment is deemed adequate.

Section 53. (1) When a well is in the process of being drilled or reconditioned, the operator shall keep at the well or at his field office and within reasonable distance of the well a daily record of the operations.

(4) The daily report shall set out complete data on all operations carried on during the day, and without restricting the generality of the foregoing, shall include.

(a) the depth at the beginning of the day or tour,
(b) the depth at the end of the day or tour,
(c) diameter of hole,
(d) any change in casing,
(e) if casing is set, all data regarding the setting with size, type, grade and weight of casing, whether new or used, and the depth at which it is set,
(f) particulars of cementing,
(g) any water, oil or gas encountered even if only small showings, and
(h) a report of each log, survey, formation test, deviation test or other test taken or made.

(5) The reports kept and filed with the Board shall note and describe, in addition to drilling operations, all other operations carried on, including fishing, shooting, perforating, acidizing, fracturing, surveying and abandonment.

Section 53. (2) The operator shall file the original copies of the daily records for each week with the appropriate field office of the Board within the next ensuing week, and shall retain the duplicate copies of the records as a part of his or the well owner's permanent record. * * *

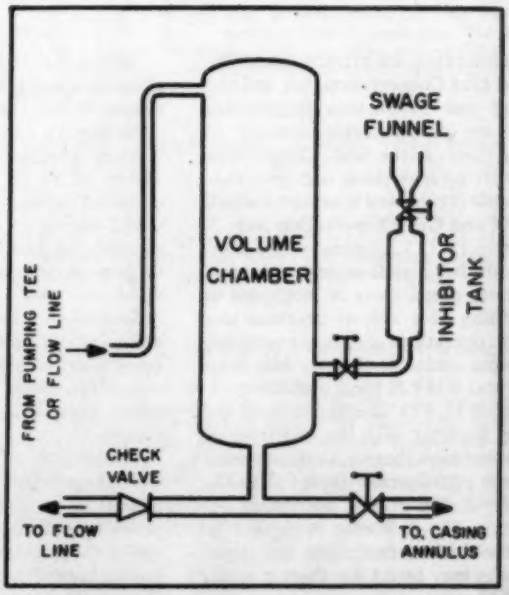
Ideas at Work

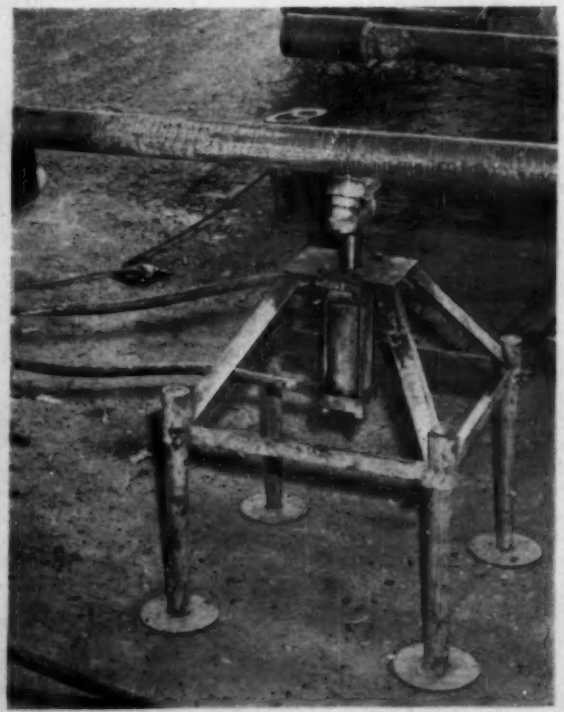
Inhibitor Hookup Saves Pumper's Time

A volume chamber hookup in connection with the conventional inhibitor lubricator has made it possible for the pumper to start the inhibiting operation and leave the well site. Later, he returns to direct the oil flow back into the flow line.

The idea is to save time for the pumper when using liquid chemical inhibitor and still permit flushing the inhibitor down into the well. A volume chamber made of large diameter casing sealed off top and bottom is fitted with a 2-in. line at the top coming from the pumping tee or flow line. Bottom of the chamber is connected to a tee which leads back to the flow line through a check valve; the other line equipped with a valve leading to the casing annulus. The conventional inhibitor lubricator setup is connected into the volume chamber as shown.

On a trip by the well, the pumper switches through the treater and produces in this manner until he is ready to treat the well. He then switches production out and puts the required amount of inhibitor into the lubricator. The valve on the line from the bottom of the volume chamber to the casing annulus is opened. The heater-treater will empty by the time the pumper makes his next trip to the well. Oil with inhibitor in it will be pumped down the casing annulus and back up the tubing. The pumper does not have to remain at the well site while treating and flushing with oil.





Hydraulic Jack Controls Pipe Level

A shop-made hydraulic jack unit can be remotely controlled to raise or lower drill pipe being hardfaced in the field. The jack device is portable and can be broken down for moving. Four legs are of 2-in. pipe fitted with disc footings. Each leg is bolted inside a collar welded to each corner of a truncated pyramid frame, as shown. The hydraulic cylinder was mounted beneath the top plate, with a pipe cradle attached to the jack piston rod.

Two such units support the drill pipe while the joint is under repairs. Hydraulic hoses connect to a simple control panel on the welding truck. The operator can quickly and easily position the drill pipe by controlling either or both hydraulic jack units.

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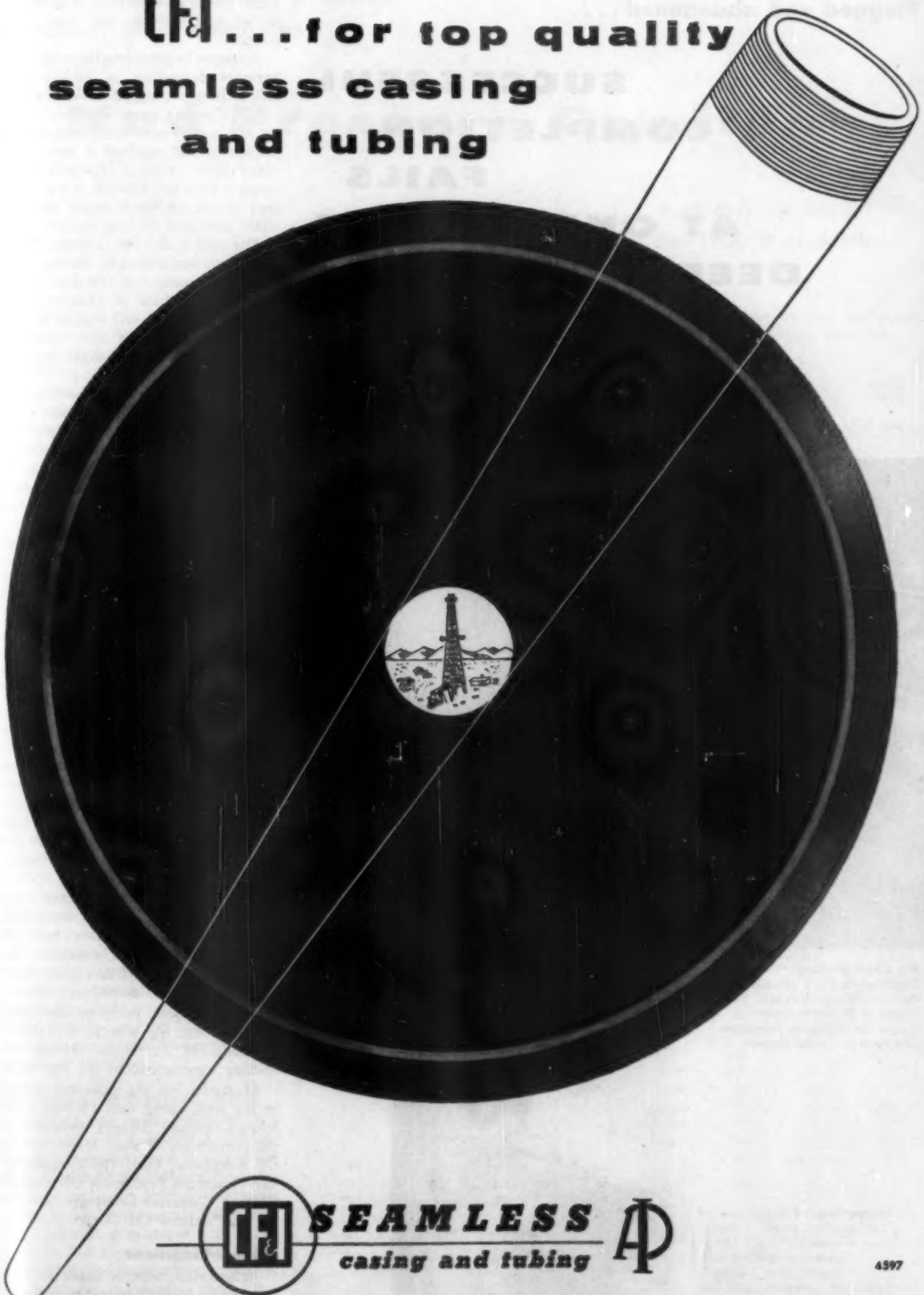

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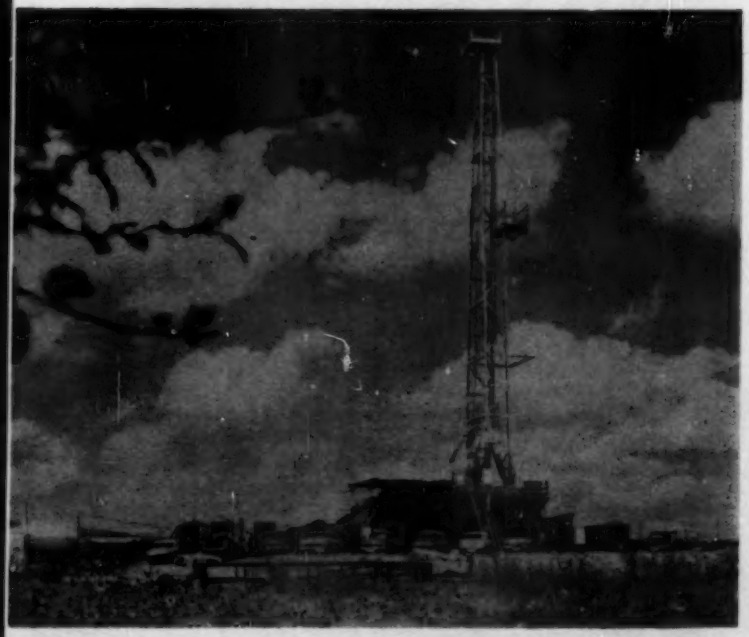
Plugged and abandoned . . .

SUCCESSFUL COMPLETION FAILS AT OKLAHOMA'S DEEPEST WELL

Magnolia's 20,426 ft Caddo County wildcat plugs back to 14,345 ft to the Springer sand for uncommercial gas, water flow



Big Chief Drilling Company's Rig 2 established the new Oklahoma depth record of 20,426 ft while drilling for Magnolia Petroleum Company in Caddo County.

— Photos courtesy Jones & Laughlin Steel Corp.

Inspection of bit — one of 265 used on the No. 1 Sterba — is made by H. C. (Dick) Clements, drilling tools foreman for Magnolia Petroleum Company, and Dan May, toolpusher for Big Chief Drilling Company.

THE DEEPEST WELL ever to be drilled in Oklahoma has been abandoned.

Attempts to complete the well in the Springer formation at 14,311-40 ft failed. It was plugged November 25.

This Caddo County well was drilled for Magnolia Petroleum Company and associates and reached a new Oklahoma depth record of 20,426 ft. It was plugged back to 14,345 ft. It was in the area of the 14,300-ft depth that gas, water and load oil flow was recorded.

The well is the No. 1 Sterba-Ordovician and was drilled by the Big Chief Drilling Company of Oklahoma City. Well was spudded in October 1956.

Casing of 16-in. OD was set at 1226 ft; 10¾-in. at 8070 and 7⅝-in. at 14,526 ft. Below that depth the hole was left open.

It had been planned to drill to the Bromide sands of the Simpson series which would have taken the well down to a record depth of perhaps 24,000 ft. A decision was made to plug back to the Springer sands, however, where possible production previously had been indicated.

Some 265 bits of various types were used, including the conventional three cone bits, jet bits, tungsten carbide tipped bits, and diamond bits.

In commenting on some of the difficulties in drilling to 20,000 ft, Dan May, of Anadarko, Oklahoma, toolpusher on the rig, said "our biggest problem has been to maintain a satisfactory mud program."

At the 20,000 ft mark, a 15.4 lb per gal drilling mud was being used. Drilling was without unusual incident. Formations drilled did not have excessively high bottom-hole temperatures.

Well is located about three miles north of Cyril, Oklahoma, in the Cement field, a field now producing at 2500 to 2800 ft.

In addition to having reached a record Oklahoma depth, if successfully completed it would have been the state's second deepest producer, and lacks by only 38 ft of being the fourth deepest well ever drilled anywhere.

Drilling tools foreman for Magnolia on the rig was H. C. (Dick) Clements. R. E. (Buck) Fowler was drilling superintendent for Big Chief.

Magnolia has the principal interest in the well, along with Phillips Petroleum Company. Others associated in the venture are: Sunray Mid-Continent Oil Company, Gulf Oil Corporation, Pan American Petroleum Corporation, Phillips Chemical Company, and Anderson-Prichard Oil Corporation.

Acknowledgment

Acknowledgment is made to Jones & Laughlin Steel Corporation for use of material used in this report. ★ ★ ★

New API recommended practice to report mud weight as

Mud Pressure Gradient

in pounds per square inch per 1000 ft of depth

FORMATION break-down pressures can be kept easily in mind by rig personnel through the use of a newly approved API method for reporting mud weight, or mud density. The Drilling and Production Practices Committee of the American Petroleum Institute has received approval of both the Central Committee and the Executive Committee and this method has been implemented into the newly published API Bulletin RP 29 on Testing of Drilling Fluids.

AAODC, Manufacturers Make Change

American Association of Oilwell Drilling Contractors has added the change to the "Mud Record" section of the AAODC-API Standard Daily Drilling Report Form. Mud testing equipment manufacturers are already engaged in making mud balances with a pressure gradient scale to assist in making the term universal.

The new recommended practice is to report mud weight as the "pressure gradient" in terms of "pounds per square inch of pressure per 1000 ft of depth," or the "hydrostatic head per 1000 ft of depth." This method will give a more usable and a more readily understood figure than other systems in use.

It is expected that the changeover to the pressure gradient system will be complete — although gradual.

Mud previously reported, for example, as 10 lb per gal (or 74.9 lb per cu ft, or 1.20 sp gr) would be recorded as 520 psi per 1000 ft.

Calculating Hydrostatic Head

This practice will eliminate the necessity of rather involved calculation of hydrostatic head at any given depth by simply multiplying the pressure gradient by the depth in thousands of feet. For example at 6385 ft a mud with a pressure gradient of 520 (10 lb per gal or 74.9 lb per cu ft) or 6.385 × 520 = 3320 psi hydrostatic head. If it were desired to calculate the hydrostatic head from the lb per gal figure, it would be necessary to use the following equation:

$$\text{Hydrostatic Pressure} = \frac{\text{depth} \times \text{weight (lb/gal)} \times 0.433}{8.33} = \frac{6.385 \times 10 \times 0.433 = 3320 \text{ psi}}{8.33}$$

Where the term "pounds per cubic foot" is used the equation would be:

$$\text{Hydrostatic Pressure} = \frac{\text{depth} \times \text{weight (lb/cu ft)} \times 0.433}{62.4} = \frac{6385 \times 74.9 \times 0.433 = 3320 \text{ psi}}{62.4}$$

— Conversion Table for Mud Gradient —

Gradient, psi per 1000 ft of depth	Density		Specific gravity	Gradient, psi per 1000 ft of depth	Density		Specific gravity
	Lb per gal	Lb per cu ft			Lb per gal	Lb per cu ft	
433	8.3	62.4	1.00	800	15.4	115.2	1.85
440	8.5	63.4	1.02	810	15.6	116.6	1.87
450	8.7	64.8	1.04	820	15.8	118.1	1.89
460	8.9	66.2	1.06	830	16.0	119.5	1.92
470	9.1	67.7	1.09	840	16.2	121.0	1.94
480	9.2	69.1	1.11	850	16.4	122.4	1.96
490	9.4	70.6	1.13	860	16.6	123.8	1.99
500	9.6	72.0	1.15	870	16.8	125.3	2.01
510	9.8	73.4	1.18	880	16.9	126.7	2.03
520	10.0	74.9	1.20	890	17.1	128.2	2.06
530	10.2	76.3	1.22	900	17.3	129.6	2.08
540	10.4	77.8	1.25	910	17.5	131.0	2.10
550	10.6	79.2	1.27	920	17.7	132.5	2.12
560	10.8	80.6	1.29	930	17.9	133.9	2.15
570	11.0	82.1	1.32	940	18.1	135.4	2.17
580	11.2	83.5	1.34	950	18.3	136.8	2.19
590	11.4	85.0	1.36	960	18.5	138.2	2.22
600	11.6	86.4	1.39	970	18.7	139.7	2.24
610	11.7	87.8	1.41	980	18.9	141.1	2.26
620	11.9	89.3	1.43	990	19.1	142.6	2.29
630	12.1	90.7	1.45	1000	19.2	144.1	2.30
640	12.3	92.2	1.48	1010	19.4	145.5	2.33
650	12.5	93.6	1.50	1020	19.6	146.0	2.35
660	12.7	95.0	1.52	1030	19.8	148.4	2.38
670	12.9	96.5	1.55	1040	20.0	149.9	2.40
680	13.1	97.9	1.57	1050	20.2	151.3	2.42
690	13.3	99.4	1.59	1060	20.4	152.7	2.45
700	13.5	100.8	1.62	1070	20.6	154.2	2.47
710	13.7	102.2	1.64	1080	20.8	155.6	2.50
720	13.9	103.7	1.66	1090	21.0	157.1	2.52
730	14.1	105.1	1.69	1100	21.2	158.5	2.54
740	14.3	106.6	1.71	1110	21.3	160.0	2.57
750	14.4	108.0	1.73	1120	21.5	161.4	2.58
760	14.6	109.4	1.76	1130	21.7	162.8	2.60
770	14.8	110.9	1.78	1140	21.9	164.3	2.63
780	15.0	112.3	1.80	1150	22.1	165.7	2.65
790	15.2	113.8	1.82				

— The AAODC-API Joint Committee on the Standard Daily Drilling Report Form.

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It is considered that this term will be of considerable assistance in making the rig personnel aware of the pressures that will "break down" certain formations in lost circulation areas as well as indicating to them the tremendous pressures required to control gas and fluid flows in abnormal pressure areas.

Daily Drilling Report

To further assist in the acceptance of the term, the "INSTRUCTIONS TO DRILLER," printed on the inside of the cover of each book of the AAODC-API Standard Daily Drilling Report forms, will carry this note and a conversion table:

NOTE TO ALL DRILLERS: The American Petroleum Institute has adopted as a recommended practice (API Bulletin RP 29, May 1957), a new method or term for reporting "mud weight" or "mud density." Instead of reporting "mud weight" in terms of "pounds per gallon" or "pounds per cubic foot," it is to be reported as **pounds per square inch per 1000 ft of depth,** or the hydrostatic head per 1000 ft of depth. The term that will be used to describe this will be *mud pressure gradient* or *pressure gradient,* as indicated on the daily drilling report form in the "mud record section."

Where mud balances are in use that do not have the pressure gradient scale on them, a table will assist you in making the conversion from "pounds per gallon" or "pounds per cubic foot" to *mud pressure gradient.*

Contractor-Operator Acceptance

Some drilling contractors have indicated immediate acceptance of the new API recommended practice.

One official of Drilling and Exploration Company of Delaware stated: "We'll go along with it," adding that, "the measure had been needed for a long time. We'll add new equipment in time. We think it is a heck-of-a good idea, and most practical, because it provides a positive method of determining the mud gradient."

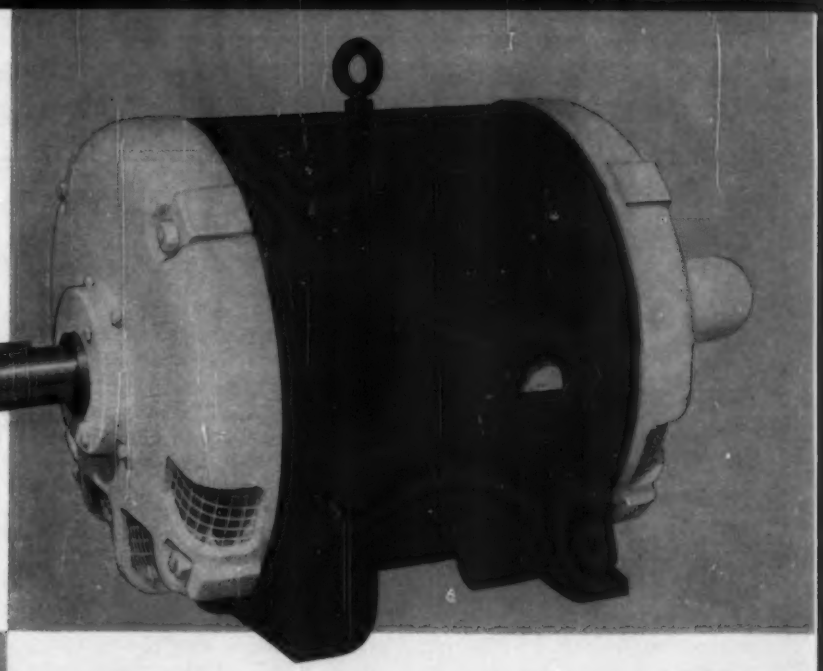
Southeastern Drilling Company spokesmen agreed that the method was a good idea and suggested that it would follow suit. "We will report the mud as our customers want us to. Foreign operations require us to measure mud in one manner, on the West Coast another, in the Southwest — still another."

Some major companies, however, have announced that they will not switch systems immediately. Others have the system already in use.

Usefulness and practicality of the mud gradient system will, of course, bring it into universal usage in time — with just as much uniformity and conformity as countless other API practices and procedures have standardized equipment, measures, and methods.

* * *

Continental-Emsco Green Triangle ELECTRIC PUMPING MOTOR



BUILT-IN BALANCE METER

-8% SLIP
75% STARTING TORQUE
UARANTEED 1.15 SERVICE FACTOR
0°C RISE

See these motors at your nearby Continental-Emsco store . . or let your C-E representative show you how they will reduce your electrical pumping costs. Bulletin available on request.

The first electric motor DESIGNED EXCLUSIVELY for oil field pumping

SAVE ON MAINTENANCE COSTS There's a built-in BALANCE METER on these motors that makes it easy to maintain good counterbalance. This lessens wear-and-tear on well equipment, reduces maintenance and costly downtime. A pumper can tell *at a glance* if the well is pumping satisfactorily. Neither an engineer nor special instruments is needed. Other *exclusive* design characteristics give cushioned peak demands for increased life of belts . . bearings . . well equipment.

SAVE ON POWER COST By checking the balance meter for uniform needle readings, the pumper is assured of maximum lifting efficiency at the lowest possible electrical cost. Motor has 5-8% slip and 275% starting torque with 1.15 *guaranteed* service factor . . 40°C rise. This can lower peak current demands and power costs.

SAVE ON INSTALLATION COSTS All the flexibility you need for easy, fast installation is incorporated in these motors. Double shaft extension is standard. Motor drives from both sides . . rotates in either direction . . leads can enter from one side or the other. An oversized, diagonally-split conduit box provides plenty of room for power line connections. Hold-down bolt holes are 21/32" *for every motor size*, so bolts furnished with unit pumper can be used . . regardless of type or manufacture.

Many other features make C-E Green Triangle Electric Pumping Motors *completely oil field* . . from the base up. Weather-guarded frame and uni-directional air cooling system assure maximum efficiency under all weather conditions. Sizes from 3 through 30 horsepower are available.

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EXPLORATION ACTIVITIES

KANSAS

★ Burch Drilling Company has recorded a new Lansing lime discovery in Trego County. Well is the No. 1 Benson, 1½ miles northwest of the Ogalah pool, drilled to the Arbuckle to a total depth of 4096 ft. Completion was made through perforations in the Lansing at 3724-27. After swabbing 10 bbl hourly, well pumped 160 bbl of oil in 24 hours. State test has been set. Top of the Lansing was called at 2650 ft, with Arbuckle called at 4063 ft.

SUMATRA

★ Failure of the Indonesian government to permit exploration and development of new concessions has caused Standard-Vacuum Oil Company to suspend oil exploration in Sumatra. The company has indicated that it is letting several of its employees go, and has indicated that it is recalling many of its American geologists and geophysicists. Stanvac maintains producing, refining, tanker, and marketing operations in Indonesia which will not be affected by the move. The company now employs about 12,000 Indonesians, and in the last 9 years has invested $470,000,000 in the area.

PARAGUAY

★ An army detachment looking for water has reported finding oil at a depth of 150 ft, government reports reveal. Discovery was made in Picuiba in the Chaco region. A special commission has been named by President Alfredo Stroessner to investigate the finding.

TEXAS

★ A new fault block north of the productive limits of the Palacios field in Matagorda County has been established by Christie, Mitchell & Mitchell of Houston, while extending the field about a quarter of a mile to the north. The operators' No. 1 Louis Hickle was completed in the Frio E sand through perforations at 8594-632 ft for an open-flow potential of 8,000,000 cu ft of gas per day. Six productive Frio sands were encountered in the well, drilled in an area considered semi-wildcat territory.

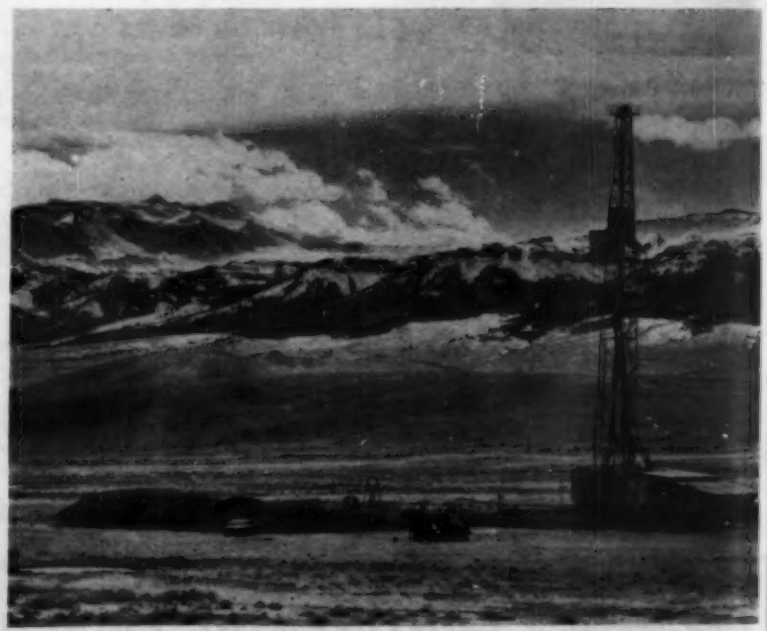
★ Texas American Oil Corporation and Haskens and Knickerbocker, both of Midland, No. 1 Omar Khayyam was completed as a Pecos County wildcat discovery for a daily potential of 165 bbl of 31.8 deg oil. The Queen sand strike is 12 miles west of the Yates pool and 17 miles west of Iraan. Well flowed and pumped through perforations from 2000 to 2012 ft. It is on a 320-acre lease and in the southeast corner of Section 98, Block 194, GC&SF survey. Operators plan to rapidly develop this lease. There is spacing for 15 additional wells on the property.

CUBA

★ Consolidated Cuban Petroleum Corporation has placed a cable tool rig over its proposed deep test in the center of the Motembo field, Las Villas, and drilling will soon get underway on Consolidated Cuban-Ira. Amp. de Yonides No. 1. It is planned to carry the well to 2000 ft with cable tools, and then bring in a rotary to drill ahead to at least 6000 ft. This will represent the first time that a deep test has been drilled in the old Motembo naphtha field, one of the most unusual areas of its kind in the world. More than a million and a half barrels of pure naphtha have been extracted from the field since its discovery in 1881. Oil men have long been interested in the possibilities of a deep well in the area, but thus far none has been drilled to a depth greater than 3000 ft. Most of the production comes from the zone from 400 to 1700 ft. Consolidated Cuban's location was made after extensive geological studies, and the objective is to penetrate the serpentine and reach the underlying limestone. According to geologists, the conditions in this area are such that there could be an accumulation of crude oil over an extent of several thousand acres under the serpentine. Consolidated Cuban holds about 7000 acres in the heart of Motembo, including an area to the north of the old field that has never been drilled.

FRANCE

★ The Societe des Petroles de Valence, in which the British Petroleum Group has a 50 percent interest, has been granted a new oil exploration permit covering 27,300 hectares near St. Julien-en-Born on the southwest coast of France. The company already has three licensed areas in France, one being in the lower Rhone Valley where preparations are being made to drill the first deep test well in the Luberon area, north of Marseilles. In the Valence Basin where two permits are held by the company, two test wells have been completed without commercial result and a further well is drilling.



New Wyoming discovery is the Husky-State No. 1, new field discovery in Park County, Wyoming. This successful wildcat is located on a block of some 7000 acres in which Husky Oil Company and Cabeen Exploration Corporation each hold a 50 percent gross working interest. On test, the well pumped 248 bbl of heavy black oil in 24 hours from perforations in the Phosphoria at 5068-94 ft and 5104-34 ft.

found: the missing link in down-hole correlation . . .

the new CORE-GAMMA SURFACE LOG!

During the past several months, Core Lab's personnel in the Permian Basin have been performing a very unusual service.

To attack the problem of correlating driller's depths versus wire line depths, a practical method was devised for *running a gamma ray logging instrument "over" core delivered to the lab for analysis.* The result is a *Core-Gamma Surface Log** — proven to be dramatically effective.

Currently, many operators in the area are coordinating this "missing link" with visual inspection of the core and down-hole gamma ray logs (from the same well or off-set tests) to pinpoint selective perforating, to accurately orient themselves within a productive section, and to precisely reconstruct the original position of lost core.

This sound, economical bridging of the gap between different types of down-hole information nails down the importance of having core available at the surface.

Again, with its new Core-Gamma Surface Log, Core Lab demonstrates how the entire industry benefits from a fully integrated field-and-research effort.

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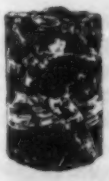

For specific details regarding the availability of Core Lab's new Core-Gamma Surface Logs, send request on your company letterhead to address below. Please mention this publication.

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WYOMING

★ Falcon Seaboard Drilling Company, Tulsa, and Caulkins Oil Company, Oklahoma City, have an indicated gas discovery at their Federal No. 1 Center of SW, SW of Sec. 8, Township 15n, Range 104w in Sweetwater County. On a drillstem test in the Lakota sand, flow was estimated to be 4,500,000 cu ft. Casing was set at 4032 ft and completion is underway.

★ Completion is being attempted at Pure Oil Company's Badwater Unit No. 1 in Natrona County. The wildcat, drilled to 17,034 ft, encountered gas production testing at the rate of 12,000,000 cu ft per day. A total of 14,345 acres are included in the unit on which the discovery was made.

NEW MEXICO

★ Two rank wildcats have been scheduled by Miami Petroleum Company in San Miguel County. The pair, both 7000 ft granite tests, are the No. 1 Hoover Ranch, C NW NW 14-12n-28e, about 13 miles northwest of Tucumcari, and the No. 1 Bell Ranch, C NW SE, 34-15n-26e, 32 miles northwest of Tucumcari. Work is underway at both locations by Henson Drilling Company at No. 1 Hoover, and by Sojourner Drilling Company at the No. 1 Bell Ranch.

★ Union Oil Company of California has indicated a gas discovery at its No. 1-26 Crawford in southeastern Eddy County. The find is located in C NW SE 26-24s-26e, 7 miles north of White City and 4 miles south of Black River Delaware pool. Union calculated a drillstem test flow of 3,000,000 cu ft of gas per day in the Pennsylvanian at 11,309-20 and 11,437-51 ft. A second test with casing perforated at intervals between 9968 to 10,157 ft yielded a flow of gas at the rate of 6,000,000 cu ft per day.

★ A Devonian discovery has been completed by Sinclair Oil & Gas Company at No. 1 State-Lea 840 in Lea County. Well flowed 198 bbl of 46.8 deg oil in 24 hours through 48/64-in. choke from perforations at 13,115-153 ft; gas-oil ratio was 300 to 1. Total depth of the wildcat is 13,260 ft. It is located in C SW SW 1-11s-34e, 12 miles northwest of Tatum near the South Four Lake field.

UTAH

★ A new oil discovery in the Paradox Basin of San Juan County, Utah, has been potentialed at the Reynolds Hatch, Ltd., No. 1 Federal. The new well, located approximately 11 miles north of the Aneth field on a 54,000-acre tract called the Hatch Lease Block jointly owned by Reynolds Mining Corporation and Three States Natural Gas Company of Dallas, Texas, flowed high gravity crude on a 6-hour test at the rate of 235.2 bbl per day. The rapid flow rate was obtained using a ¼-in. choke through perforations from 5967-87 ft in a 5½-in. production casing set at 6047 ft. Gravity of oil was 43.2 deg. A 6-hour official potential test on the new oil well flowed high gravity crude at the rate of 732.56 bbl per day and the gas-oil ratio was 1080 cu ft of gas per bbl of oil. The new wildcat is the fourth exploratory well in the "C" Zone of the Paradox limestone formation which produces in the Aneth field. Three earlier wells drilled by the combine were dry holes.

LIBYA

★ More than $50,000,000 will be spent by 12 companies for drilling and exploration of concessions in Libya in the coming year, reports indicate. Most of the concession-holders will drill during 1958. Three companies have slated tests to begin this month. One well is to be drilled near the Idris airport south of Tripoli by the British d'Arcy Exploration Company. French Petroleum Company will drill near the Algerian border in the vicinity of Edjele oil wells. Mobil Oil of Canada is to drill in Syrtica.

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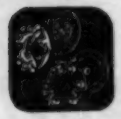
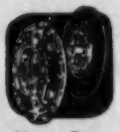
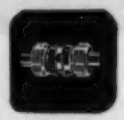

Small Spring Loaded


Heavy Duty Spring Loaded


Oil or Dry Multiple Disc

Heavy Duty Over Center

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Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

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CLUTCHES

FLORIDA

A 14,000 ft test by Humble Oil and Refining Company has been staked in the Everglade swamps of Palm Beach County. The well, No. 1 State-1004 is 6-mile southwest of the Miami Canal and 20 miles south of Okeelants. Test is expected to go to the Sunniland. The well was spotted by radio control. A 2½-mile road to the location has been built. Location was constructed of sand and coral reef from the swamp beds.

PAKISTAN

★ Three widespread wildcats are now underway in Pakistan by Pakistan Petroleum, Ltd. One is at Lalmai, one at Bannh, and one just commenced at Adhi. The third is the No. 2 Adhi, a joint venture with Pakistan Oilfields, Ltd. PPL has also announced the drilling of Karsal Well No. 2 by POL to develop jointly the Pira Jangla and Karsal concessions, which cover the same structure.

TURKEY

★ Drilling operations have begun in southeastern Turkey at the first exploratory well undertaken by a group consisting of Atlantic Refining Company, Seaboard Oil Company and Tidewater Oil Company, with the latter serving as operator. Located in the Mt. Bakuk area approximately 15 miles northeast of Nusaybin, the wildcat well is scheduled to test the Cretaceous section productive in Iraq to the south.

LOUISIANA

★ The Texas Company announced an on-structure wildcat, the State Lake Peigneur No. 13, Jefferson Island dome, Iberia Parish, has been completed as a new gas well. On a test, the well produced 5,100,000 cu ft of gas and 19 bbl of 47.6 deg condensate per day on a 18/64-in. choke with flowing tubing pressure of 3650 psi. The perforated interval was 9002-9010 ft. Well is located approximately one mile northwest of the nearest production.

★ Cities Service is locating an 11,000-ft Oligocene test six miles south of Baton Rouge, in West Baton Rouge Parish. The joint-interest operation is Australia Planting No. 1, located in the southwest corner of Township 8-s, Range 13e, Section 7-8s-13e. Test is four miles south of the University (Baton Rouge) pool. The William G. Helis estate owns 50 percent interest, Cities Service will have 50 percent and will operate.

VENEZUELA

★ San Jacinto Petroleum Corporation and its partners, Tennessee Gas Transmission Corporation, Union Oil and Gas Corporation of Louisiana, Lion Oil Company Division of Monsanto Chemical Company, Murphy Corporation, Sharples Oil Corporation and American Petrofina, Inc., have announced the completion of the Marlago No. 1 as an oil well in Lake Maracaibo, Venezuela. The well tested 5760 bbl per day of 27.1 deg oil. This rate of flow was through a ¾-in. choke with tubing pressure of 900 psi. The Marlago is located on block 575, consisting of approximately 2000 acres. Foundations have been built for the drilling of four additional wells on the block and two rigs currently are being employed.

★ Outstanding completion of SVSX Well No. 5 as an oil producer in Venezuela's Lake Maracaibo Block No. 1 was announced by the Venezuelan Sun Oil Company, Venezuelan Atlantic Refining Company and Seaboard Oil Company group. Well tested at the rate of 7080 bbl a day of 32 deg oil through a ¾-in. choke. According to Venezuelan Sun, the operator, well is flowing from perforations in the Eocene horizon from 9470 to 9570 ft. Total depth of the well is 9693 ft. Approximately 900 ft of oil-bearing sand was encountered. The trio is developing a new portion of the lake.

★ Drilling operations have started on the second of two wells by Sunray Mid-Continent Oil Company and associates on recently acquired concessions in Venezuela. The new well, identified as the Lake San Jacinto Group (LSG No. 0-1) is drilling ahead below 4180 ft after setting surface pipe. This well, like the first well, Lake Phillips Group Well (LPG 1-1) now drilling at approximately 10,152 ft on Lot 17 of the Lake Maracaibo concession, will test the Miocene, Eocene, and Cretaceous sands to total depth of approximately 13,500 ft. Sunray owns a 5 percent interest in the San Jacinto group project and a 17.27 percent interest in the Lake Phillips Group project. Phillips Petroleum Company is the operator of both units and interests are held by 6 other companies.

★ Signal Oil and Gas of Venezuela, operator of a 28,000-acre concession in Lake Maracaibo, Venezuela, for foreign subsidiaries of Signal Oil and Gas Company, Hancock Oil Company, The Pure Oil Company and The Standard Oil Company (Ohio), have announced results of the initial test on their exploratory well, Centro 2X. At the rate of 2400 bbl a day, the well flowed clean 40 deg gravity oil on a 5/8-in. bean in a 3-hour test with 1125 psi pressure on the tubing. Signal reported. After the well was perforated from 12,113-183 ft and changed from mud to water, it started flowing and cleaned up in 2 hours. After completion the rig will be moved to the next location to drill Centro 3X, approximately one mile northwest of the present well site.

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(Made in Aluminum or Malleable Iron)
For Grooved End Pipe

● Think back—remember the effort required to make and complete pipeline joints? Now you can do it an easier way with these two-bolt malleable iron Couplings. Pipeline progress dictated the design of Alumiron Couplings making them the simple, quick, positive, low cost way to join grooved-end steel, aluminum, cast and wrought iron and spiral pipe.

● Alumiron speedily joins grooved-end pipe by the mere tightening of two bolts which run through the coupling halves. The Buna N or oil resistant Neoprene gasket inside the coupling halves firmly and evenly grips the pipe ends making a leak-proof seal which increases as pipeline pressure mounts. This flexible Coupling permits the line to "come and go" with rough and uneven terrain. Component parts are interchangeable with other grooved-end couplings.

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The High Cost of Heart Disease – Hearts come only one to a customer. That is why it is urgent for you to keep up the fight to guard yours from disease. Diseases of the heart and circulation kill more than 800,000 persons annually. An estimated 10,000,000 people are afflicted – 500,000 of them children.

Research Is Saving Hearts – Thanks to heart research, some forms of heart disease now can be prevented, some cured, and almost all cases can be helped through proper treatment after early diagnosis. Thousands of Americans are now living because research has developed new methods of preventing and treating certain forms of heart and circulatory disease.

Invest in the Heart Fund – When you give to the Heart Fund, you are making an investment in your future. You are helping your Heart Association bring the latest advances to your doctor so that he may guard your heart and the hearts of those you love. Your Heart Fund contribution helps your Heart Association fight Heart disease through:

- ***Research***
- ***Public and Professional Education***
- ***Community Heart Programs***

GIVE TO FIGHT HEART DISEASE

Help your Heart Fund Help your Heart

Camay Drilling Company, a Southern California Petroleum Corporation subsidiary, has entered into a joint venture agreement with Compagnie Industrielle de Travaux (Citra) to contract for oil well drilling in North Africa and other French areas of influence, R. O. Turner, Camay executive vice president, has announced. The Citra-Camay group has ordered 2 new drilling rigs capable of drilling to 14,000 ft for immediate shipment to the Hassi Massaoud oil field in the Sahara for development work.

★ ★ ★

Canadian exploration work continued at a fast pace in 1957 almost unheeded, states a recent Sulmac Exploration Services Newsletter. In 1957 over 222 drilling rigs were engaged in exploration and development drilling. This led to the completion of nearly 900 exploratory wells during the year and the addition of over 500,000,000 bbl of oil reserves in Canada. A mid-1957 survey indicated that 100 geophysical crews were at work in western provinces. Last year, Sulmac reports, the industry invested nearly $550,000,000 in exploration, development and production activity — probably one half of this sum spent on exploration, with as much as 10 percent spent for geophysical work alone.

★ ★ ★

Canadian Delhi Oil Ltd. has entered into an agreement with the French Government and a French oil company to secure a concession in Algeria. Being formed is a French subsidiary, Franco Delhi, S.A. (Frandel), which will own half of the concession when obtained. The other half is to be divided between Societe de Participations Petrolieres (Petropar), a firm created by the French Government for the venture, and Compaigne Franco-Africaine de Recherches Petrolieres (Francarep). It will be several months before the concession is actually granted.

OIC Exhibits Popular

Trim Rig — Queen Marilyn Patrick of the 1957 Los Angeles County Fair, Pomona, California, learns about drilling equipment and drilling rig operation from Felix Chappellet, vice president and general manager, Western Oil & Gas Association; F. R. "Dutch" Schmeider, general superintendent production department, Shell Oil Company, (Chairman, Southern California OIC); and Olen Lane, vice president, Continental Oil Company, (first vice president, Western Oil & Gas Association), at the Whittier OIC Fair booth. It was estimated that 200,000 people saw the oil exhibit, and was characteristic of large crowds drawn at OIC exhibits on display at state fairs and oil shows throughout the nation.

What the WELL-DRESSED, MEDIUM-PRESSURE Wells are wearing

This well is equipped with the compact "Tee Base Type" HERCULES Duplex Stuffing Box and HERCULES "Type SO" Tubing Head. The Tubing Head is equipped with HERCULES original overhead packing arrangement and self-aligning hinged slips, making this a simple yet complete hook-up, featuring safety with simplicity and minimum of parts.

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What's doing in DRILLING

★ **Survey of rotary drilling activity** made in late November 1957, showed a continuing slump at a season when it usually increases rapidly. Hughes Tool Company tabulations placed the number of active rigs operating in the United States and Canada on November 25 at 2519, down 24 from the 2543 in service on November 18.

Tabulation reflected decreases in both this country and Canada. The domestic figure, declining for the third straight week, dropped from 2357 on November 18 to 2351 on November 25. The Canadian count slipped from 186 to 168 after a two-week, 21-rig increase. Both Canadian totals included two rigs in eastern Canada with the remainder in western Canada.

★ **Drilling hydraulics of jet bits** is the subject of a manual which has been prepared by Dr. Walter L. Moore, professor of civil engineering, the University of Texas, for the Oil Tool Division of Chicago Pneumatic. This bulletin has been prepared to make it possible for a person with limited technical training to obtain solutions conveniently to the hydraulic problems frequently encountered in drilling with jet bits. Graphs covering a normal range of the variables involved make rapid numerical solutions to these problems possible.

★ **The American Petroleum Institute** has adopted as a recommended practice a new method or term for reporting mud weight. Instead of reporting mud weight in terms of "lb per gal" or "lb per cu ft," the new API code recommends that it be reported as "lb per sq in. per 1000 ft of depth," or the hydrostatic head per 1000 ft of depth. This practice will eliminate the necessity of rather involved calculation of hydrostatic head at any given depth and should make rig personnel aware of pressures required to control gas and fluid flows in abnormal pressure areas.

For further explanation of the new code and some comments by drilling contractors, see the article on B-119.

★ **"Mister Cap," offshore drilling rig,** holds possibly a record for short length of time from christening to first producing well. The span was 12 days.

The offshore platform was christened in a two-day open house at New Orleans November 1-2, and brought in its first producer November 14. Rig was built for Barnwell Offshore, Inc., Shreveport, Louisiana, by R. G. LeTourneau, Inc.

★ **Canadian Delhi Oil, Ltd.** has entered into an agreement with the French government and a French oil company to secure a concession in Algeria. Under terms of the agreement, Canadian Delhi will form a French subsidiary, Franco Delhi, S.A., which will own half of the concession when obtained. It will be several months before the concession is actually granted.

★ **The Canadian depth record** of 14,696 ft has been broken by Arrow Drilling Company's Rig 21, the Tulsa firm has reported. Working for British American Oil Company, Ltd. at No. 6-4 Lambert Creek, 6-4-51-21w, Alberta, Canada, the rig was pushing tools below 14,802 ft.

★ **Camay Drilling Company,** Southern California Petroleum Corporation subsidiary, is currently preparing two rigs to be used in its joint operation in Libya with Compagnie Industrielle de Travaux (Schneider Enterprises). The drilling companies will drill development and step-out wells in the Hassi Messaoud oil field in the Sahara under contract for Francaise des Petroles de Algerie. Objective will be to delineate and develop the big field discovered only about a year ago.

★ **Adma Enterprise,** first drilling barge of its type to be used in the Middle East, has arrived at its base at Das Island in the Persian Gulf after a 6800-mile tow from Germany. Drilling of the first underwater deep test well to be undertaken by Abu Dhabi Marine Areas, Ltd., in which British Petroleum is associated with Compagnie Francaise des Petroles, is due to begin early in January.

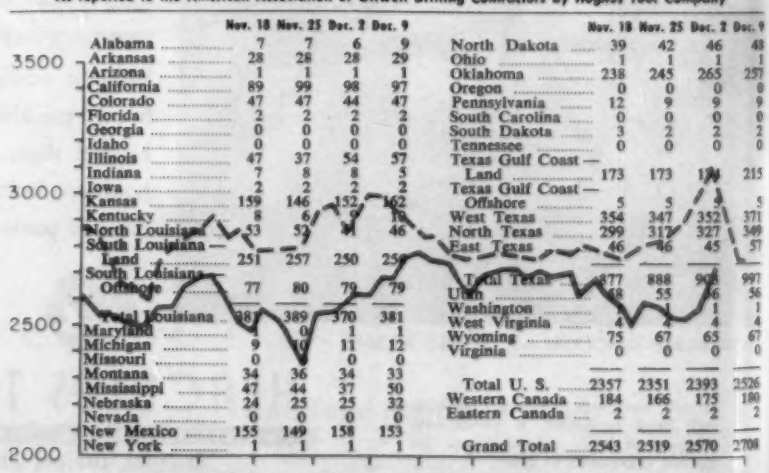
Extensions will be welded to each of the four 10-ft diameter legs of the barge making them 161 ft long. The 140-ft high drilling rig will be assembled before the barge is towed 20 miles to its working position.

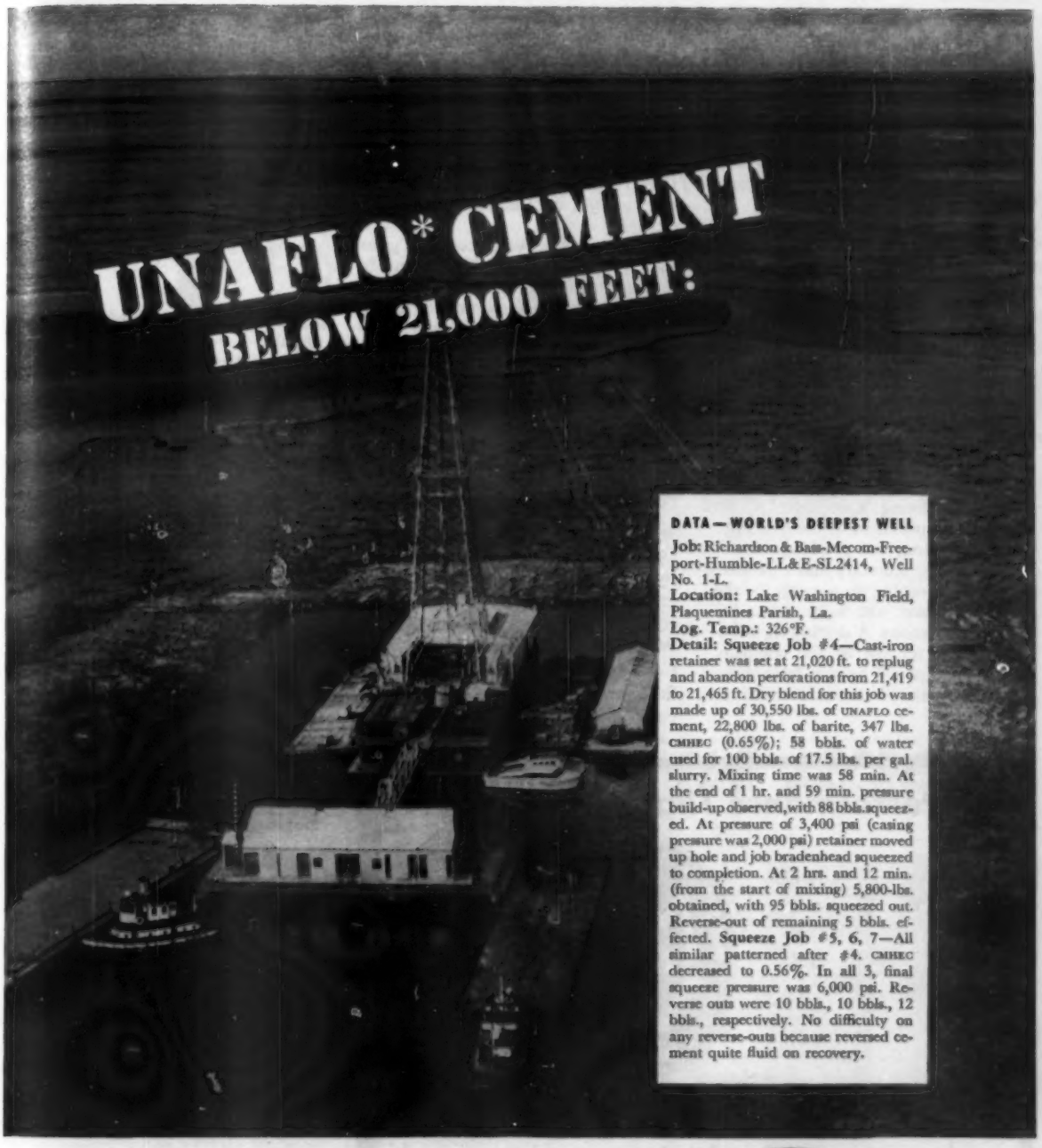
★ **Offshore California drilling island** is nearing completion. After dumping rocks five miles out in the Pacific from Ventura County since February 1957, Richfield Oil Corporation's man-made island finally broke the surface recently. When completed, the island will contain 400,000 tons of rocks and 126,000 cu yd of fill material and will have a surface area of about one acre. Some 68 wells can be drilled from the island, its designers claim.

Rotary Rigs Operating in Oil Fields of United States and Canada

As reported to the American Association of Oilwell Drilling Contractors by Hughes Tool Company

	Nov. 18	Nov. 25	Dec. 2	Dec. 9
Alabama	7	7	6	9
Arkansas	28	28	28	29
Arizona	1	1	1	1
California	89	99	98	97
Colorado	47	47	44	47
Florida	2	2	2	2
Georgia	0	0	0	0
Idaho	0	0	0	0
Illinois	47	37	54	57
Indiana	7	8	8	5
Iowa	2	2	2	2
Kansas	159	146	152	162
Kentucky	8	6	9	10
North Louisiana	53	52	51	46
South Louisiana — Land	251	257	250	259
South Louisiana — Offshore	77	80	79	79
Total Louisiana	381	389	370	381
Maryland	1	0	1	1
Michigan	9	10	11	12
Missouri	0	0	0	0
Montana	34	36	34	33
Mississippi	47	44	37	50
Nebraska	24	25	25	32
Nevada	0	0	0	0
New Mexico	155	149	158	153
New York	1	1	1	1
North Dakota	39	42	46	48
Ohio	1	1	1	1
Oklahoma	238	245	265	257
Oregon	0	0	0	0
Pennsylvania	12	9	9	9
South Carolina	0	0	0	0
South Dakota	3	2	2	2
Tennessee	0	0	0	0
Texas Gulf Coast — Land	173	173	176	215
Texas Gulf Coast — Offshore	5	5	5	5
West Texas	354	347	352	371
North Texas	299	317	327	349
East Texas	46	46	45	57
Total Texas	877	888	905	997
Utah	48	55	56	56
Washington	1	1	1	1
West Virginia	4	4	4	4
Wyoming	75	67	65	67
Virginia	0	0	0	0
Total U. S.	2357	2351	2393	2526
Western Canada	184	166	175	180
Eastern Canada	2	2	2	2
Grand Total	2543	2519	2570	2708





DATA—WORLD'S DEEPEST WELL

Job: Richardson & Bass-Mecom-Freeport-Humble-LL&E-SL2414, Well No. 1-L.
Location: Lake Washington Field, Plaquemines Parish, La.
Log. Temp.: 326°F.
Detail: Squeeze Job #4—Cast-iron retainer was set at 21,020 ft. to replug and abandon perforations from 21,419 to 21,465 ft. Dry blend for this job was made up of 30,550 lbs. of UNAFLO cement, 22,800 lbs. of barite, 347 lbs. CMHEC (0.65%); 58 bbls. of water used for 100 bbls. of 17.5 lbs. per gal. slurry. Mixing time was 58 min. At the end of 1 hr. and 59 min. pressure build-up observed, with 88 bbls. squeezed. At pressure of 3,400 psi (casing pressure was 2,000 psi) retainer moved up hole and job bradenhead squeezed to completion. At 2 hrs. and 12 min. (from the start of mixing) 5,800-lbs. obtained, with 95 bbls. squeezed out. Reverse-out of remaining 5 bbls. effected. **Squeeze Job #5, 6, 7**—All similar patterned after #4. CMHEC decreased to 0.56%. In all 3, final squeeze pressure was 6,000 psi. Reverse outs were 10 bbls., 10 bbls., 12 bbls., respectively. No difficulty on any reverse-outs because reversed cement quite fluid on recovery.

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For typical data tables, write:
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U-183

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B-129

Drilling

★ **United Fruit Company** is exploring the possibility of oil production in Panama. Over the past decade, the big banana producer has diversified in a small way by developing cacao, African palm oil, teak wood, and rubber. Now, following the lead of several independent oil companies, United Fruit wants to get in on Central American oil production.

For over six months, the company has been exploring a 1,000,000-acre area on the Pacific side of Panama near the Costa Rican oil strikes of Union Oil Company. Union Oil is reportedly the only oil company so far to hit pay dirt in Central America.

★ **Reading and Bates, Inc.,** Tulsa, has announced the formation of a wholly-owned subsidiary to drill in the Barinas area of southwestern Venezuela. The new firm, Reading and Bates Company de Venezuela, will drill for Venezuela Atlantic Refining Company. J. W. Bates, Jr., is president of the new firm; C. E. Thornton, vice president, and J. W. Bates, Sr., secretary and treasurer. Company is setting up a camp for the U. S. employees who will conduct the drilling operations. A drilling rig is being shipped for use by the company and other rigs will be sent later. First well will be started about December 15 near Barinas.

★ **A 35-year offshore oil drilling contract** has been signed by the Hermosa Beach, California, city council with Shell Oil Company and Continental Oil Company. Also approved was a five-year onshore drilling lease jointly presented by Bandini Petroleum Company, Southern California Petroleum Corporation, Anderson-Prichard Oil Corporation, and Climax-Molybdenum Company.

The offshore drilling contract gives the two companies drilling rights in tideland areas within the city's corporate limits and would permit Union Oil Company of California and Superior Oil Company to participate with Shell and Continental if the latter two companies so desire. The four companies comprise the offshore "CUSS" group. The contract calls for an overall $11,100,000 cash bonus, $500,000 of which was turned over to the city directly when the contract was signed.

★ **M. L. Benedum,** often called "The Great Wildcatter," has again proved his right to the title with a triple strike in three widely scattered sections of the country: Conneaut, Ohio; Gillette, Wyoming, and Brooks County, Texas. Companies participating in these three fields are Hiawatha Oil & Gas Company, Benedum-Trees Oil Company, and Penn-Ohio Gas Company. Most newsworthy of the three strikes was the one in Ashtabula County, Ohio, near the lakeport town of Conneaut. Only about 50 miles from Titusville, Pennsylvania, the site of the country's first oil well, this is an area long since thought exhausted of oil and gas in paying quantities. Just 5 miles from the Pennsylvania state line, this well had an initial production of 150 bbl per day and leveled off to 60 bbl per day on a 3/16-in. choke.

★ **Seacat Drilling Company,** newly organized, has contracted to drill for government-owned Iran Oil Company. Two rigs are now operating in Iran. The drilling firm is a combination of Southeastern Asia Drilling Company and Contracting and Trading Company, Beirut, Lebanon. Principals in

Southeastern Asia are Southeastern Drilling Corporation, Dallas (W. P. Clements, Jr., president) and Turnbull and Zoch, Corpus Christi, Texas. Officials of the new contracting company met in Dallas recently. Shown in photo are: Paul Turnbull, Turnbull and Zoch; Emile Bustani, member of Lebanese Parliament and president and board chairman of The Contracting and Trading Company; Frank Zoch, Turnbull and Zoch; Jerry Cunningham, vice president of Southeastern Drilling, Dallas; Andre Tabourian, assistant to Bustani.

★ **Drilling operations are underway** on Atlantic's first wildcat well in the Pinar del Rio Province of Cuba. Located near the town of Los Palacios, some 60 miles southwest of Havana, the well is expected to reach a depth of approximately 9000 ft.

This is the first of a series of tests on Atlantic's substantial full interest holdings in Pinar del Rio Province after completing extensive seismic exploration during the last year. Jones Brothers Drilling Company, Shreveport, Louisiana, has been named contractor.

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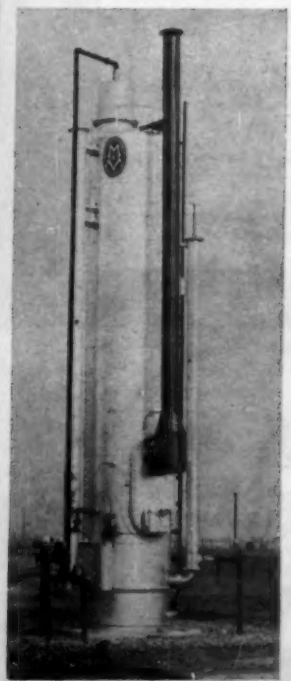

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RUNNING TOUR with MEN in the INDUSTRY

Fred H. Moore, coordinator of domestic production, has been appointed general manager of the producing department, Socony Mobil Oil Company, Inc. His successor as coordinator of domestic production is **Henry L. Waszkowski,** who has also been named a member of the producing committee. Prior to his new assignment, Waszkowski was assistant to the manager of the company's producing department.

S. A. Berthiaume has been elected vice president and manager of the Texaco Exploration Company, a wholly owned subsidiary of The Texas Company. Before his election, he was assistant to the vice president in charge of The Texas Company's domestic producing department.

Ken E. Boling, production superintendent for Bishop Oil Company in Abilene, Texas, has been appointed production superintendent for the Pembina district of Canadian Bishop Oil, Ltd., with headquarters at Drayton Valley, Alberta.

Travis M. Slagle has been elected president of Georesearch, Inc. Slagle has served as exploration and operations manager for Greenbrier Oil Company of Fort Worth and St. Paul for the past several years. Other officers elected include: **J. A. Crichton,** chairman of the board; **C. A. McCartney,** vice president; **John Novak,** vice president, and **Preston A. Peak,** secretary-treasurer. A vacancy on the board was filled by the election of **D. H. Ankeny** of St. Paul. His affiliations include serving as a director of the Northwestern National Bank of Minneapolis, Hamm Brewing Company, and Lithium Corporation of America.

Ruth Bachrach, Denver, has been promoted to assistant to the regional geologist for Continental Oil Company's Rocky Mountain region. She will continue to make her headquarters in Denver. During the past 9 years, she has served as a staff geologist in Conoco's Denver regional office.

R. E. McAdams, exploration manager, has been named vice president, exploration, of Shell Oil Company; he will continue to have general responsibility for the handling of exploration and land matters. **R. W. Bond,** production manager, was named vice president in charge of the Tulsa exploration and production area. Bond will succeed **C. P. Bristol,** vice president in charge of the Tulsa area, who will become vice president of the Midland, Texas, area. **J. E. Clark,** now vice president in Midland, will move to New York as vice president-production, replacing Bond.

Promotion of four men to new positions in Continental Oil Company's southwestern region exploration department has been announced. **J. C. Cooper,** Casper, Wyoming, division geologist, promoted to the newly created position of assistant regional geologist, with headquarters at Fort Worth, Texas. **W. H. Fitzgerald,** Amarillo, Texas, division geologist, promoted to regional research geologist. He succeeds **C. D. Vertrees,** who retired recently. **J. L. Deffenbaugh,** Roswell, New Mexico, geologist, promoted to division geologist at Amarillo, succeeding Fitzgerald. **L. A. Dinges,** Midland, Texas, geologist, promoted to the newly created position of assistant division geologist at Midland.

Seven men were named to newly created positions in Conoco's petrochemical sales organization. **V. F. Beyer,** director of Bryton sales, named director of petroleum sulfonate sales, with headquarters at New York. **J. W. Jackson,** sales manager for Conoco's Sherwood refining division, to director of sales administration. He will continue to make his headquarters at Englewood, New Jersey. **V. F. Kavanagh,** eastern sales representative, named director of detergents sales, with headquarters at New York. **D. G. Schreck,** domestic sales manager, Sherwood refining division, to director of white oil and petrolatum sales, with headquarters at Englewood. **R. S. Mooney,** technical sales representative, to director of sales promotion, New York. **S. W. Harris,** midwest sales representative, named regional sales manager, Chicago. **H. G. Greene,** district sales manager at Englewood, appointed regional sales manager there.

Magnolia Petroleum Company's board of directors elected **William W. Clawson** a director and vice president. He will also have duties as coordinator of exploration and producing activities. In 1956, Clawson was appointed coordinator of domestic production for Socony Mobil Oil Company. From this New York post he is transferring to Dallas to take up his new management duties with Magnolia, Socony Mobil's southwestern affiliate.

W. W. Clawson

E. J. Deu Pree

E. J. Deu Pree of New Orleans will succeed **T. B. Flood** as vice president and general manager of production of The California Company. Flood, a director of the company, retired December 31 from Calco after more than 37 years of service. He has been vice president of the company for over 15 years. Deu Pree, presently assistant manager of production, in his new position will direct Calco's production activities which cover a wide area from the Rocky Mountains to the Gulf of Mexico.

J. D. (Mitch) Williamson has been named a staff geologist in the production and supply department, Trunkline Gas Company. He comes to Trunkline Gas from Gulf Oil Corporation, where for the past 7 years he served as a staff geologist in the Houston area.

Richard J. Murdy, chief geologist for New York State Natural Gas Corporation since 1952, has joined the parent firm, Consolidated Natural Gas Company, in New York. He will assist the vice president.

J. R. Sanders, Denver, has been promoted to regional geologist for Continental Oil Company's Rocky Mountain region. Formerly assistant regional geologist, Sanders will continue to make his headquarters at Denver and will succeed **Dr. Bruce F. Curtis,** who has resigned to become an associate professor in geology at the University of Colorado.

Promotion of four men to key positions at Conoco's Rocky Mountain region geological staff were announced. **John W. Strickland,** Casper, Wyoming, promoted from assistant division geologist to division geologist at Casper and with **Glenn G. Hager,** Ardmore, Oklahoma, to assistant division geologist at Casper, succeeding Strickland. **Charles A. Tallard,** Billings, assistant division geologist, promoted to the newly created position of regional staff geologist, with headquarters in Denver. **Robert C. Busby,** Casper, geologist, to succeed Tallard.

Lee A. Keeling and **W. T. Ford** have opened offices in Tulsa's Philtower Building to serve as consulting petroleum engineers under the company name of Keeling and Ford. Both Keeling and Ford formerly were with the Keplinger and Wanenmacher Company, Tulsa petroleum engineering consultants. Keeling, a University of Tulsa graduate in petroleum engineering, previously worked for Wright Petroleum Laboratories and Magnolia Petroleum Company. Ford, an engineering graduate of Oklahoma State University, formerly was with Carter Oil Company and Deep Rock Oil Corporation.

Charles V. Mahaffey of Midland, Texas, has been appointed district geologist at Roswell, New Mexico, for Cities Service Oil Company. He succeeds **M. F. Kennedy,** who has taken a foreign assignment with another Cities Service company. Mahaffey was serving as staff exploration geologist at the company's Midland division office. He was employed in 1948 after graduating from Oklahoma University with a degree in geology.

F. J. Decker, division landman in the Ohio Oil Company's Shreveport production division, retired after 43 years with the company. He is succeeded by **G. R. Baldwin,** assistant division landman.

D. W. Farnham has been appointed the new operating superintendent for foreign operations; **J. D. Wells** becomes assistant to the chief engineer, and **G. F. Moore** is assistant sales superintendent, Pan American Petroleum Corporation. All three men, former Tulsa residents, have recently completed assignments with Amoco Chemicals Corporation at Brownsville, Texas. All are former Pan American employees who had been with Amoco since early this year, when Amoco took over Pan American's chemical plant operation at Brownsville.

Ralph Ludwick, field superintendent for Pan Am, was transferred from Hays, Kansas, to Ulysses to supervise the company's Hugoton area producing operations. He replaces **W. M. Warren,** who has been assigned as field superintendent for Pan American's West Edmond, Oklahoma, area.

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Running Tour

Dr. R. G. Hamilton of Hamilton Well Log Consultants, Tulsa, Oklahoma, is visiting Venezuela, spending 6 weeks delivering lectures on well log interpretation to groups of geologists, engineers and geophysicists in Anaco, San Tome, Lagunillas, Maracaibo and Caracas. Four elementary and two advanced well log interpretation schools will be conducted.

George F. Berry, New Orleans, Louisiana, has been promoted to assistant regional geophysicist for Continental Oil Company's southern region. Formerly division geophysicist for Conoco at New Orleans, he will make his new headquarters in Houston and will succeed **J. W. Wilson,** who recently transferred to Oklahoma City as regional geophysicist for the company's central region.

G. A. Davidson, vice president and director, Standard Oil Company of California, has been appointed a member of the board of the Fifth World Petroleum Congress, Inc. The six-day Congress, scheduled for May 1959 in New York, will provide opportunity for exchange of information on latest techniques employed by the world-wide oil industry.

Bert Davies has been appointed contact representative for the Kansas district, Garvey Drilling Company. He will operate from the Wichita offices. The firm is represented by **Bill Garms** and **Neal Colby** in Oklahoma City. **Frank G. Kozak** is in the central field offices in Great Bend, Kansas as contact manager.

Three geologists and two engineers have been added to the Tulsa and Calgary, Alberta, Canada, offices of Alex W. McCoy Associates, Inc. Joining the Tulsa office are: **F. M. (Mac) Stewart,** former staff engineer and specialist in reservoir engineering for Pan American Petroleum Corporation; **Myron L. Vance,** former geologist for Sunray Mid-Continent Oil Company, and **O. Lewis Smith,** former division petroleum engineer for Sun Oil Company. New men for the Calgary office are **Elmer L. Herbaly,** who until joining McCoy was zone geologist for Gulf Oil Corporation in Oklahoma City, and **William Slemko,** who also was a geologist for British American Oil Company.

John K. Ontko has been promoted to regional geologist in charge of geological activities in the Calgary regional office of Plymouth Oil Company. He was with Pacific Petroleums, Ltd. and Royalite Oil Company, Ltd. prior to joining Plymouth Oil.

Philip G. Reynolds has been promoted to assistant drilling superintendent of Rimrock Tidelands, Inc. He formerly supervised Rimrock crews operating six rigs in Israel for Matsada. Toolpushers **E. G. Brumley** and **G. H. Cloninger** have been assigned duties on Rimrock's two new offshore self-contained platforms. Brumley will be toolpusher for Rig No. 15 on the B platform in Block 175 Eugene Island area. Cloninger will be one of the toolpushers on Rig No. 14, in Block 190, Eugene Island area.

Other toolpushers reassigned to the new platform rigs are **G. E. Roberts,** who transferred from Rimrock Rig No. 3, located on Block 86, South Timbalier area to the Block 190 Rig No. 14, and **Gillis Windham,** who transferred from a land-based rig to Rig No. 15 on the Block 175 B platform.

The directors of Signal Oil and Gas Company have elected **James B. Taylor Jr.** a member of the board. Taylor, who has been with Signal since 1926, is also assistant manager of the company's gas department.

C. C. (Larry) Liedholm was named to the new position of assistant general manager of the crude oil production department of Signal. He had been manager of operations in the production department. The new manager of operations is **R. C. Vlack,** previously assistant manager of operations. Another new position in the production department is held by **J. T. Carriel,** assistant manager of engineering, formerly chief evaluation engineer for the department.

J. W. Wilson, Houston, Texas, has been promoted to regional geophysicist for Continental Oil Company's central region, with headquarters in Oklahoma City. Formerly assistant southern regional geophysicist for Conoco at Houston, he succeeds **E. L. Mount,** who recently was promoted to superintendent of the geophysical section's operations division at Ponca City, Oklahoma.

Frederick L. Becker has returned from military service and rejoined the production engineering division of Gulf Research & Development Company, as a research engineer assigned to well completion problems.

The Petroleum Engineer **Annual Index for 1957**

The editorial index of articles published in all editions of *The Petroleum Engineer* during 1957 is now available.

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Your Public Relations:

HOW GOOD?

Here's a handy check list of 50 questions to ask yourself in evaluating your PR efforts

Paul Lockwood

SOME BUSINESSMEN think of public relations in much the same way as they do of their fire station—to be called when there is an emergency. Public relations, good public relations, is preventative medicine—not the doctor or the undertaker.

What is public relations?

Even today public relations is a mystery to many oil company executives. Some, for instance, consider it a high science. Others think of public relations as printed publicity. Actually, public relations is just good common business sense in the way a company conducts its business with the public. The things that you and your employees do mold public opinion —good or bad—about your firm.

You cannot go out and buy a pound, gallon or cubic yard of public relations. It is not for sale. You and your organization must create it. You must plan it. And, you must work on it to make it a success.

Here is a check list of the elements that go into making a successful public relations program for a company. Check each of the points listed that you can honestly answer with an unqualified "yes." Then, add up your check marks, multiply by two, and you will have your score for your firm's present public relations. The unchecked questions will point the way to developing a more successful public relations program for your company.

Public Relations Check List

Civic Responsibility

——Do you belong to organizations in your community in each of these classifications—church, lodge, service club?
——Do you take an active part in at least one of these organizations of which you are a member?
——Are you a strong supporter of programs designed for the civic betterment of your community even though there is no personal gain involved?
——Do you participate in the recognized worthy charity drives in your community?
——Do you contribute your business know-how, facilities, and time to make every civic enterprise a success?

Personnel Relations

——Does your salary and employee benefit program compare favorably with other employer's plans in your community?
——Do you take a genuine and sincere interest in your employees and in their problems?
——When it is necessary to discharge or layoff an employee, do you explain the situation completely to the worker?
——Do most of your advancements to better positions in your company come from within the organization?
——Do you keep all of your employees informed about the goals, problems and position of your company all the time?

Business Correspondence

——Do you answer all letters you receive as promptly as possible?
——Do your business letters have a pleasant, friendly tone that gives a true impression of your oil company?
——Do you personalize your letters so that the person receiving the letter does not feel "you say that to everyone?"
——Is there anything in your letters that might have a different meaning than the one you intended?
——Does the physical appearance of your letters create the kind of impression you want people to have of your firm?

Telephone Technique

——When answering the telephone, do you have a "smile" in your voice?
——Do you introduce yourself and give your company identification when answering the telephone?
——Do you make it a point to get your caller's name when you start talking on the telephone?
——Do you personalize your telephone conversation by using the caller's name while talking?
——Do you always answer your telephone calls as promptly as possible?

Advertising Attitude

——Do all of your advertisements fit into the character you want to create for your company?
——Are your advertisements prepared in good taste to give people a feeling of confidence in your firm?
——Do you avoid the tendency to knock your competition in your advertising?
——Do all of your advertisements have some means of identification for your company?
——Do you avoid any misleading or semi-true advertising that will be a business boomerang?

Printed Publicity

——Do you know the publisher or editor of your local newspaper personally?
——Do you keep your newspaper informed of any personal or business activity that is newsworthy?

——Do you avoid the tendency to be a "publicity grabber" for any little thing that happens?
——Do you refrain from complaining about the amount of publicity you receive in comparison with other businessmen?
——Do you give the commonplace publicity about your oil company a different twist to make it more interesting?

Handling Complaints

——Do you make every effort to handle all complaints and adjustments promptly?
——Are you fair in all settlements offered to your customers about their complaints?
——When you are at fault, do you quickly shoulder the blame instead of grudgingly making an adjustment for the customer?
——Do you live up to the spirit as well as the letter of all agreements you make with your customers?
——When dealing with a "chronic complainer" are you fair, but firm?

School Relations

——Do you have special arrangements made with local school officials to handle speaking assignments on the oil industry?
——Have you considered a special scholarship for outstanding students to give your company better recognition with parents and the students?
——Have plans been made for handling tours of your plant for school groups?
——Do you know and inform local school people about films on the oil industry that are available?
——Do you encourage your employees to take advantage of the special evening instruction offered by local schools?

Creditor Relations

——Do you pay all invoices as promptly as possible within the dating allowed?
——Are you fair in seeking credits and adjustments from the vendors involved?
——Do you recheck carefully on any errors that seem to indicate a difference between the invoice amount and the amount received?
——When it is necessary to delay payment of an invoice for some reason, do you inform the vendor of the situation?
——Do you consider salesmen calling on you business friends rather than as business enemies?

Credit Accounts

——Do you carefully explain all rules and regulations about your billing procedure when service is started?
——When following-up over-due accounts, do you have a system that still holds the good will of these slow paying customers?
——Do you have a convenient system for people to pay their bills?
——Do you give people every opportunity to make some plan of settlement before taking drastic action on your over-due bills?

These 50 questions will give you a cross-section of your public relations program. All are important to the future success of your business. All have a bearing on the opinion the public will have of your company. By applying good common sense to any areas that show a weakness, you can improve your public relations in your community. ★ ★ ★

How to Write a Readable Business Report

Management reading and writing time is saved when essential reports are written in a readable, fact-packed style

H. E. Carroll

● **Get to the Point.** Long-winded introductions waste executive time in reading and writing. Don't tell what you are going to report on — report on it. State your purpose quickly and concisely.

● **Picture Your Reader.** Who is going to read the report? What does he know about the subject? Does he have any preconceived ideas? Does he have a technical background of oil industry terms? Visualize your report reader and write directly to him.

● **Express . . . Don't Impress.** You wouldn't have the report to write if there was any doubt about your ability. You don't have to waste time trying to be impressive — you are. Write to express facts and ideas — not to impress top brass or employees.

● **Highlight Main Points.** Outline your report before writing. Select main ideas or facts. Highlight these main points in outline form as you write. Indent sub-topics and explain briefly as necessary.

● **Keep It Easy to Read.** Readable report writing follows five basic rules:

1. Well-known words
2. Personal references
3. Short sentences
4. Short paragraphs
5. Short reports

Following these five rules will make your report easy to write . . . easy to read.

● **Be Logical.** First things should come first. Follow through in a logical step-by-step order. Don't start with yesterday, jump to tomorrow, and then back to today. Use space or time progression to keep your business report on the track.

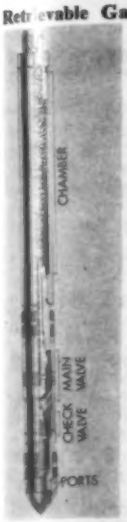
● **End Properly.** Don't leave any loose ends. A business report can end in these two ways:

1. Brief summary
2. Recommendation for action

When you have touched all bases in your report, you are through. Stop! ★ ★ ★

NEW Drilling and Producing EQUIPMENT

Retrievable Gas Lift Valve. Otis has announced a new retrievable gas lift valve which has 2 moving parts and can be used for either continuous or intermittent flow, simply by making changes at the wellhead. The tool is a completely balanced valve and tubing pressure has no effect on its operation. The opening pressure of the valve can be positively calculated as the valve is sensitive to casing pressure only. The valve has no uncontrolled spread and the operator has complete control of the gas that is injected at the surface, on either continuous or intermittent lift. It is run with a standard kick-over tool and lands in a standard side-pocket mandrel. *Otis Engineering Corporation.*



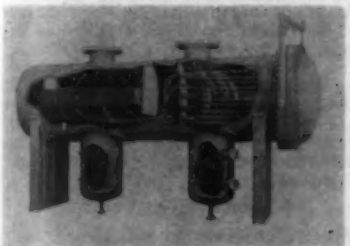
Circle number (1) on reply card.

Lighted Pushbutton Switch. A new space-saving lighted pushbutton switch is being marketed by Micro Switch, a division of Minneapolis-Honeywell. By combining indicator light and switch in 1 compact assembly, pushbutton switch cuts panel space requirements in half. Two subminiature single-pole double-throw basic switching elements offer versatility of circuitry.

The indicator lamp socket is fastened to the outer body of the switch and does not move when the button is pushed. Terminals of the indicator light are separate from those of the switch, allowing the indicator light to operate on any circuit desired. A wide selection of translucent buttons is available, in many sizes, shapes and colors. *Minneapolis-Honeywell Regulator Company.*

Circle number (2) on reply card.

Filter-Separator Unit. Designed to separate liquids from gas streams containing finely-divided fog or mist, the Peco Filter-Sep unit operates as a 2-stage system. Gas is first pre-conditioned by coalescing the liquid particles into larger droplets that are not able to "float" in the gas stream.



Enlarged droplets are then removed by a wire mesh mist eliminator section. The unit will remove airsols and fogs from gases, as well as filter out traces of foreign solid matter. *Perry Equipment Co.*

Circle number (3) on reply card.

High-Altitude Normalizing Kit. The reduction of engine horsepower caused by operation at high altitudes can now be eliminated on the Caterpillar D8 tractor by the use of a normalizing kit. The kit overcomes the cause of high-altitude power loss — insufficient oxygen to permit complete combustion of fuel. The turbocharger delivers air to the inlet manifold at greater-than- atmospheric pressure, thus permitting complete fuel combustion and restoring sea-level horsepower up to 10,000-*ft altitude. Caterpillar Tractor Co.*

Circle number (4) on reply card.

Recording Thermometer for Automatic Custody Transfer. Automatic recording of temperature of oil in automatic custody transfer operations is now possible with a new temperature recorder introduced by Partlow Corporation. A mercury bulb, suspended vertically in the tank, samples the average temperature, transmits the expansion through a capillary tube to the instrument body mounted on the outside of the tank. The lever system transmits the expansion from a diaphragm to a recording arm on which a pen is mounted. Thermometers are available in 24 and 48 hr or 7 day chart movements, either electric or spring driven. Each instrument is shipped with 100 charts, which have been specially designed for easy readability. *The Partlow Corporation.*

Circle number (5) on reply card.

Transistorized Power Converters. New transistorized power converters which will find wide usage whenever it is desired to obtained high voltage d-c from a low voltage d-c supply are available from SIE in the TPC Series. The TPC-2 is designed for 12-v input and 150-v, 400-ma or 300-v, 200-ma output. It draws 6.85 amp full-load and 1.12 amp no-load. This small, compact unit has an efficiency of better than 75 percent and is expected to be invaluable in replacing dynamotors and vibrator-type power supplies. It will operate at ambient temperatures up to 150 F under continuous full-load conditions. *Southwestern Industrial Electronics, Inc.*

Circle number (6) on reply card.

New Rotary Machine. A new rotary machine announced by National Supply has a 20½-in. opening with a 53¼-in. API spacing for the sprocket mounting. The rotary, designated A-205, has the rectangular shape which simplifies installation in the derrick substructure and permits rig flooring to be fitted up flush with the table top on all 4 sides for safer working areas. A cartridge type pinion shaft assembly permits removal of the whole unit by means of a bolted end plate. This assembly provides permanent alignment of bearings and a means of adjusting the pinion with the gear without disturbing alignment. *The National Supply Company.*

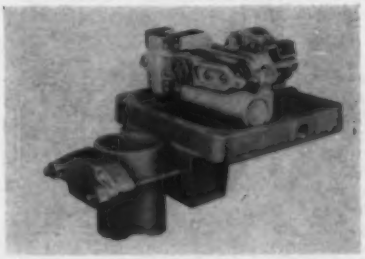
Circle number (7) on reply card.

Plastic Coated Aluminum Pipe. This pipe, suitable for use under highly corrosive conditions such as salt water disposal lines, is now being manufactured from Kaiser Aluminum pipe by Tube-Kote. Aluminum pipe is coated with baked polyurethane coating which gives excellent resistance to salt water, acids, caustic fluids, crude oil and other corrosive agents. Its superior bonding qualities and flexibility provide long service life.

The new pipe is available in a complete range of sizes in Schedules 5, 10 and 40. *Tube-Kote.*

Circle number (8) on reply card.

Temperature and Pressure Transmitter. New, compactly designed temperature and pressure transmitters have been announced by Mason-Neilan. Transmitters are pneumatic force-balance devices employing gas-filled thermal systems for temperature measurement and bellows elements for pressure. Balanced beam design permits mounting of the transmitters in any position without positional error.



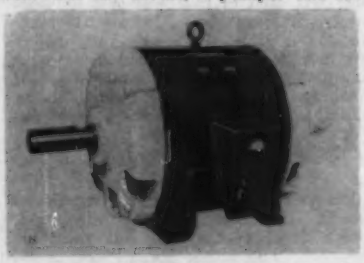
Unit sub-assembly construction is used throughout, permitting removal of sub-assemblies without disturbing beam assembly. Thermal systems and pressure elements are readily removed for change of range span and the units are compensated for ambient temperature and barometric pressure. *Mason-Neilan.*

Circle number (9) on reply card.

Casing Centralizer. A casing centralizer with springs pre-stressed in assembly is announced by Byron Jackson. The pre-stressing makes possible tremendous centralizing power within a slim overall design and eliminates need for welds and rivets. Spring ends are inserted in formed metal pockets on the end cages and are held fast by the built-in tension. High-alloy tempered silicon manganese steel is used for the springs. *Byron Jackson Tools, Inc.*

Circle number (10) on reply card.

Oilfield Pumping Motor. An electric pumping motor designated as C-E Green Triangle incorporates many features to meet the demands of oilfield pumping. By glancing at the needle of a balance meter built into the motor, a pumper can see



at a glance if the well is pumping satisfactorily and economically. The balance meter gives an accurate gage for balancing the well. Two shaft extensions are standard on the motor. Motors operate at 1200 rpm and are available in 3, 5, 7½, 10, 15, 20, 25 and 30 hp. *Continental-Emsco Company.*

Circle number (11) on reply card.

Punched-Tape Typewriter. A major advance in office automation has been achieved with the new Remington Rand electronic punched-tape typewriter. When used as an ordinary electric typewriter in preparing source documents, it automatically translates data into a punched tape for subsequent automatic processing. When fed the punched tape prepared by it or other machines, it automatically reads and types out the information at the rate of 120 words per min.

The machine can be adapted to various data-processing programs and can unify remote work stations, speed input and output to and from a centralized processing system and bring automation down to the level of basic source paperwork. Tapes punched can be reconverted to punched cards for automatic tabulation of records, reports and statistics, either on the premises or at a service bureau. *Remington Rand.*

Circle number (12) on reply card.

Improved Mud Balance. A new 4-scale extended range mud balance has been developed by Baroid to conform to the new API code 29 for specifying the density of drilling mud. The balance has on the front the lb per gal and the lb per sq in. per 1000 ft of depth scales. On the back are the lb per cu ft and the specific gravity (kilograms per litre) scales. Extended scales run from 6 to 24 lb per gal or equivalent. *Baroid Division, National Lead Company.*

Circle number (13) on reply card.

Single Well Hydraulic Pumping Package. The production of a hydraulic pumping installation for single wells is announced by Kobe. It is designed as a package surface unit to allow "well by well" equipping of a lease until the final central power plant for multiple well operation can be installed. The unit consists of a high-pressure hydraulic pump and a small power-oil reservoir tank. A gas engine or electric motor can be used to complete the skid-mounted package. Range of well depth is to 15,000 ft and the unit handles volumes up to 400 bbl per day. Power oil is supplied directly from production. *Kobe, Inc.*

Circle number (14) on reply card.

New Packing Design. A new pump-packing design manufactured by Universal Packing & Gasket increases the life of rods and packing in petroleum services. The packing, UTEX-J, is also being tested for polish rod applications. Incorporating a flexible lip, a non-crushable construction and an OD that will seal in worn boxes, the same basic J design is made up in a variety of formulations, including designs for duplex piston-type slush pumps and plunger-type pumps handling fresh and salt water, oil, propane, butane, naphtha and other chemicals. *Universal Packing & Gasket Company.*

Circle number (15) on reply card.

Ultraviolet Sample Tester. A new device for the detection of ultraviolet fluorescence of hydrocarbons has been announced. The tester operates on 2 6-v batteries, a 12-v car battery or 110-v a-c or d-c current and features a narrow band filter which gives maximum oil fluorescence with reduced mineral fluorescence. White lamps facilitate visual inspection and the removable eyepiece section permits insertion of a microscope. *Arvel Industries.*

Circle number (16) on reply card.

NEW LITERATURE

For more information on items described here in brief, use the handy reply card and circle the corresponding numbers

Junk Basket Bulletin. A bulletin from Driltrol describes the company's dieformed junk basket and outlines the operating technique of the tool. A table gives basic dimensions of the basket ranging in nominal size from 3¾ to 12 in. Tool operates through application of weight which drives steel fingers through a die curving and interlocking them to form a basket around the junk. *Driltrol.*

Circle number (17) on reply card.

Mono-Seal Coating Bulletin. A new bulletin presents the features, properties and characteristics of Mono-Seal, a plastic type protective coating. The coating is a chemo-setting synthetic resin formulated from a special blend of silicones and epoxies that cures both by solvent evaporation and internal polymerization. The bulletin gives complete data on application, drying time, coverage and surface preparation and includes a color chart of 22 colors available. *Mono-Seal Products.*

Circle number (18) on reply card.

J&L Extreme Line Casing Bulletin. A new 8-page bulletin from Jones & Laughlin features Extreme Line casing for deep, high-pressure wells. The booklet outlines the manufacturing and testing of the casing and includes a table showing features and specifications of the casing and joints. *Jones & Laughlin Steel Corporation.*

Circle number (19) on reply card.

Cable Support Folder. A folder is being offered by T. J. Cope as a permanent file for information on cable supports. The file offers information on how to install cable supports and illustrates use of metal cable troughs, ladders and channels with resulting savings in space, weight and cost. *T. J. Cope Division, Rome Cable Corporation.*

Circle number (20) on reply card.

Orifice Meter Bulletins. Five new bulletins describing orifice meters and instruments have been completed by American Meter. The literature includes descriptions of integrating orifice meters, gas lift meters, 2-position controller for parallel meter operation, Dri-flo orifice meter, and remote pilot unit for remote loading of pressure regulators. *American Meter Company, Inc.*

Circle number (21) on reply card.

Fire Department Supplies. American LaFrance has released its new product catalog entitled "Fire Department Supplies." The catalog is a listing of all firefighting equipment and accessories. The 84-page book includes all models of fire extinguishers inspected and approved by the Underwriters' Laboratories as well as hoses, accessories, signals, safety equipment and other fire apparatus. *American LaFrance Corporation.*

Circle number (22) on reply card.

Fluid End Parts Bulletin. National Supply's fluid end parts for slush pumps are presented in a new 8-page illustrated bulletin which also contains installation and maintenance tips. Parts include fluid valve and seat, fluid piston, piston rods and packing, and fluid cylinder liners. *The National Supply Company.*

Circle number (23) on reply card.

PGAC Logging Handbooks. Two new handbooks from PGAC contain 13 performance charts on the PH-125 neutron/neutron log which provides accurate evaluation of formation porosities. The charts provide a source of comparison of the PH-125 with other type (neutron/gamma) instruments. *Perforating Guns Atlas Corporation.*

Circle number (24) on reply card.

Bronze Goods Catalog. Pubco Bronze offers a new bronze goods catalog covering their line of corporation stops, service stops, curb stops, fittings and valves. The products are fully illustrated and described and all are guaranteed to meet AWWA specifications. The catalog also contains a convenient comparison chart which lists, opposite the Pubco Bronze stock numbers, the stock numbers of other manufacturers making similar products. *Pubco Bronze.*

Circle number (25) on reply card.

Blower-Compressor Bulletin. Four-page bulletin announces CycloBlower, an axial-flow, positive-displacement blower for compression and vacuum service in a range from 85 to 3342 cfm. Bulletin includes table of engineering data for 8 models and performance curves for 3 models. Curves show brake horsepower and capacities in cfm for selected speeds and 6 pressures. Table gives speed range and dimensions of each model as well as cfm and brake horsepower at 5, 10 and 15 psig. *CycloBlower Company.*

Circle number (26) on reply card.

Pre-Fabricated Wire Rope Assemblies. Now precision lengths of wire rope with fittings permanently attached by swaging are pre-fabricated to order by specialists. Assemblies are made ready for installation on equipment and can be carried in stock thus assuring the correct fittings attached and the correct length of wire rope for the machine intended. Announcement showing examples of prominent manufacturers equipment using pre-fabricated "safe-lock" assemblies is contained in publication Ropeology No. 50. *Macwhyte Company.*

Circle number (27) on reply card.

Thinking about writing a paper or article? "How to Write Better Technical Articles" has been reprinted by *The Petroleum Engineer* and is available to all readers at no charge. This 3-page article, written by John L. Kent, chief of Consolidated Electrodynamic's editorial bureau, shows how material should be organized and presented, and it contrasts basic factors in 4 forms of writing.

Circle number (28) on reply card.

New Projects in refining gas processing petrochemicals

Socony Mobil Oil Company has awarded contract to the Lummus Company for construction of a 19,000 bbl per day delayed coking unit at their Paulsboro, New Jersey, refinery. Construction of the unit will begin in the first quarter of 1958 with completion scheduled for early 1959. The unit will upgrade heavy residual oils into gasoline and fuel oils with an estimated 765 tons of coke produced a day.

The **Texas Company** has started work on a deep water dock 2½ miles north of their new Anacortes, Washington, refinery. The dock, 5600 ft long with a 1200 ft L-head at the end, is being erected in 50 ft of water and will be large enough to handle one super tanker and a smaller one.

Creole Petroleum Corporation has announced plans for construction of a $7,650,000 lube oil plant at their Amuay refinery in Venezuela. Foster Wheeler Corporation has the contract for construction with completion scheduled for mid-1958. Innovations at this plant are the use of hydrogen instead of clay in finishing of the lube oils and immediate packaging after their production.

Esso Standard Oil Company has awarded a contract to Foster Wheeler Corporation for construction of one of the world's largest alkylation units, to be built at Esso's Baton Rouge refinery. With a capacity of 10,000 bbl per day of motor alkylate, this unit is a duplicate of the one now being constructed at Esso's Bayway, New Jersey, refinery. Basic-process design was done by Esso Research & Engineering Company.

Pemex, the Mexican Government controlled oil company, has announced plans to build a large gas processing plant in the state of Tabasco. Estimated to cost $12 million, the plant will process 300 MMcf per day and will reinject the dry gas into the field formation.

Consumers Cooperative Refineries, Ltd., will soon install a 3000 bbl per day delayed coking unit at its Regina, Saskatchewan, refinery. Expected to produce about 145 tons of coke per day, this product will be used by the aluminum industries in Canada. Contract for the unit has been given to Fluor Corporation of Canada, Ltd., with engineering by UOP. Completion is scheduled for late 1958.

Esso Standard Oil Company has scheduled one of the world's largest catalytic reforming units to be built at their Baton Rouge, Louisiana, refinery. The new 27,000 bbl per day Powerforming unit will use a catalyst developed by Esso Research & Engineering Company. Part of a $46 million expansion program, the new unit is scheduled for completion in late 1958.

A program to boost catalytic reforming capacity has been started by Standard Oil Company of California at two of their West Coast refineries. At Richmond, a 22,000 bbl per day reformer is already under construction and at Bakersfield, construction of a 5500 bbl per day unit is to begin shortly. Bechtel Corporation has been awarded the engineering and construction contracts on both these units, with completion slated for mid-1958.

Friesia Oil Company, a recently organized firm, has announced plans to commence construction in March 1958, of a $17,500,000 refinery in West Germany. Plans call for the Ralph M. Parsons Company to construct the refinery and operate it for the first 18 months, assuming any loss should the refinery fail to produce at a pre-determined cost level.

Anic of Italy has concluded a licensing agreement for construction of a Houdry dehydrogenation unit. The unit, with a design capacity of 20,000 tons of butadiene annually, is now in the engineering stage at Houdry. Construction should begin sometime in mid-1958, at Ravenna, Italy.

The California Oil Company has announced award of contract to the H. K. Ferguson Company for construction of a catalytic reformer at its Perth Amboy, New Jersey, refinery. Feed hydrodesulfurization will be incorporated into the unit. Process design was done by California Research Corporation under a license from UOP.

Hercules Powder Company will soon double the capacity of its urea plant at Hercules, California. To be completed in late 1958, it will be able to produce 20,000 tons per year.

General Chemical Division of Allied Chemical & Dye Corporation will build a sulfuric acid plant at Anacortes, Washington. This plant will take hydrogen sulfide and spent alkylation acid from the nearby Texaco and Shell refineries. To be located on a 16-acre site, construction is scheduled to begin in early 1958.

Standard Oil Company of California has recently announced award of contract to the Fluor Corporation, Ltd., in excess of $2,000,000 for design, engineering and construction of a 275,000 lb per hr steam generating plant and facilities at the El Segundo, California, refinery. New plant, to be installed as part of an existing catalytic cracking unit, will use both natural gas and catalyst regenerator flue gas as fuel. Construction is scheduled to begin in August 1958, with completion set for March 1959.

North Star Oil, Ltd., has announced plans for construction of a catalytic reforming unit at its new 11,000 bbl per day refinery at St. Boniface, Manitoba. Contracts for this unit, estimated to cost $1,500,000, have not yet been awarded.

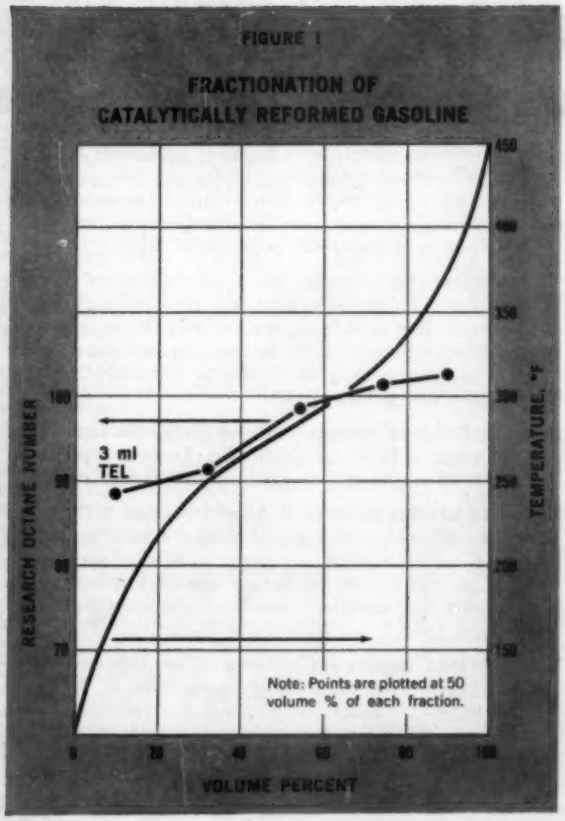
Sun Oil Company has completed negotiations for construction of a $4 million gasoline plant at Laverne, Oklahoma. Construction was expected to begin about January 1.

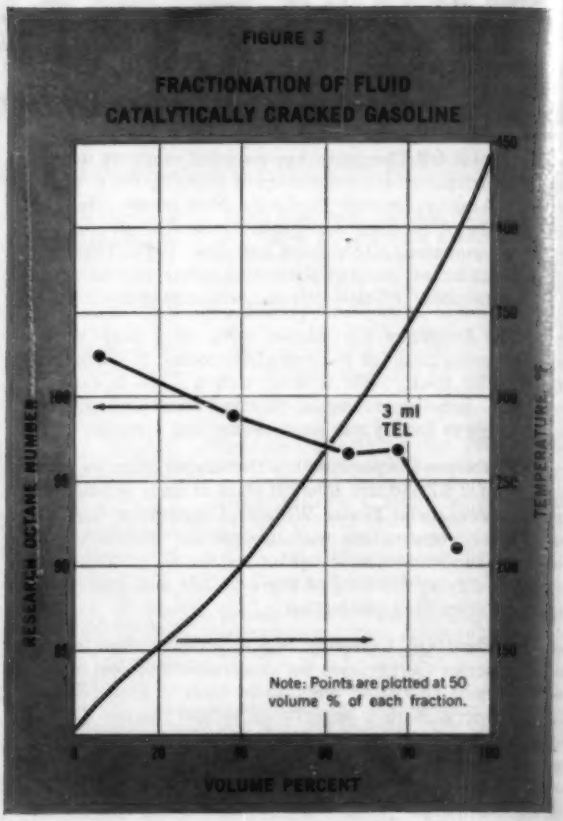
Cities Service Oil Company has started construction on a $27 million refinery in Trafalgar Township, west of Toronto, Canada. The project, to be completed in 1959, will receive western crude through the Interprovincial pipeline with products to be distributed in southern Ontario and western Quebec.

Getty Oil Company has announced plans to build a major refinery in West Germany. Located on the Rhine River near Rees, the company has a 440-acre site under option with a tanker terminal also in prospect. Refinery and terminal are estimated to cost $95 million.

Excelsior Refineries, Ltd., is planning to build a new refinery at Pas, Manitoba, Canada. With an estimated cost of $1½ million, the refinery will have a capacity of approximately 3000 bbl per day. The refinery is now in the engineering stage with construction scheduled to begin sometime in mid-1958.

The Smiley Gas Conservation Plant, a newly organized operating company, has their new $750,000 gas processing plant about to commence operations. Owned by four Canadian companies, the plant will process 300 MMcf per day. Plant is located in the Smiley area of Saskatchewan with residue gas scheduled to be sold to Saskatchewan Power Corporation.





Ethyl's Octane Profiles Help Refiners Achieve More Economic Octane Numbers

FRACTIONATION of a reformate or cracked stock and an analysis of the cuts for octane and other inspection qualities by Ethyl Research Laboratories yield data that can be a very valuable tool for refiners in their continuous efforts to improve gasoline quality.

These data, referred to as "octane profiles," can be used as design bases for splitting both catalytically cracked and catalytically reformed gasolines. Such information is particularly valuable when refiners are planning how to use blending components most efficiently and economically in the production of 100 Research octane fuels.

FOR FURTHER INFORMATION ON
ADVERTISED PRODUCTS, SEE READER SERVICE CARD

Advantages of Splitting Reformate Are The Same As for Cracked Stock

Splitting catalytically cracked and catalytically reformed gasoline at the refinery into light and heavy fractions offers the following advantages:

1. no loss in yield
2. improves premium octane quality at low capital investment and low operating costs
3. segregates components of high anti-knock quality
4. balances premium and regular grade volatility
5. permits a milder reforming level for a given premium octane requirement with resulting yield advantage

of the fuel over the ranges fractionated.

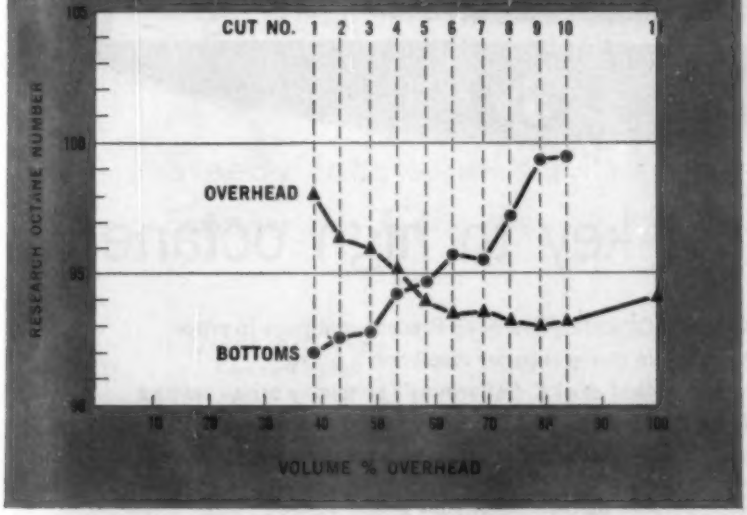
Engineers from Ethyl's Refinery Technology Group can recombine these cuts stepwise to develop a relationship as indicated below in Figure 2. This chart shows the quantity of stock that can be recombined to satisfy any given Research octane requirement.

A comparison of Figures 1 and 3 shows how catalytically cracked stocks can be handled in conjunction with catalytically reformed stocks to gain premium octane quality with balanced volatility.

The lower boiling portion of the catalytically cracked stock is combined with the higher boiling portion of the reformate. Then the remainders can be combined for use in regular grade fuel.

FIGURE 2

CALCULATED RESEARCH OCTANE NUMBERS OF CORRESPONDING OVERHEAD AND BOTTOMS



Product splitting can be a very economical way to gain additional octane quality in premium gasoline.

Reformate and Cracked Stock Cuts Can Be Recombined To Satisfy The Need for Higher Research Octane Number

Typical data for an octane profile of a reformate are shown in Figure 1.

Fractionation of the fuel that is under study into narrow cuts can be made on either a volume basis or a boiling range basis. Each cut then is subjected to a complete laboratory inspection in order to obtain the distribution of the properties

Blend 100 RON Fuels from 97 RON Base Stocks

Using data contained in an octane profile, and with the help of Ethyl Refinery Technologists, one refiner found he could produce a 100 RON blending stock (at 3.0 ml TEL/gal.) from 50 per cent of his 96 RON catalytic reformate (at 3.0 ml TEL/gal.).

Another refiner was shown that 45 per cent of his 97 RON catalytically cracked gasoline (at 3.0 ml TEL/gal.) rated in excess of 100 RON (at 3.0 ml TEL/gal.).

So, from stocks rating no higher than 97 RON, a refiner can selectively blend 100 RON gasoline yet satisfy volatility and other critical test requirements.

How Ethyl Research is helping you

Ethyl Research Laboratories in Detroit can help you evaluate the best cut points for your particular stocks.

The fractionating equipment available for this work includes 4-inch and 4-inch Oldershaw columns, 1-inch and 2-inch packed columns, and 1-barrel and 3-barrel stills.

These facilities for the close fractionation of gasoline and the services of Ethyl's Refinery Technology Group are available through your Ethyl Representative for many different kinds of studies.

These studies may include evaluation of reformer charge stocks, development of selective blending data for special boiling-range fuels, or any similar investigations you need.

ETHYL CORPORATION
New York 17, N. Y.

ETHYL ANTIKNOCK COMPOUND — ETHYL CORPORATION

RESEARCH LABORATORIES:
1600 W. Eight Mile Road, Ferndale 20, Mich.
2600 Cajon Road, San Bernardino, Calif.

CATFORMING

...your low-cost key to high octane

Atlantic's Catalytic Reforming Process continues to prove its ability in giving superior results on a broad variety of feed stocks. Catforming's simplicity brings savings through increased efficiency every step of the way—actually eliminating many profit-robbing intermediate steps.

Regardless of the volume of your charge stock, Catforming deserves your attention. One major reason that Catforming has "proved out" commercially is attributable to Atlantic's broad experience in all phases of petroleum refining and processing.

We invite your inquiries on Catforming. Write or wire The Atlantic Refining Company, Research and Development Dept., P.O. Box 8138, Philadelphia 1, Pa.

ATLANTIC

it's the CATALYST that counts

FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

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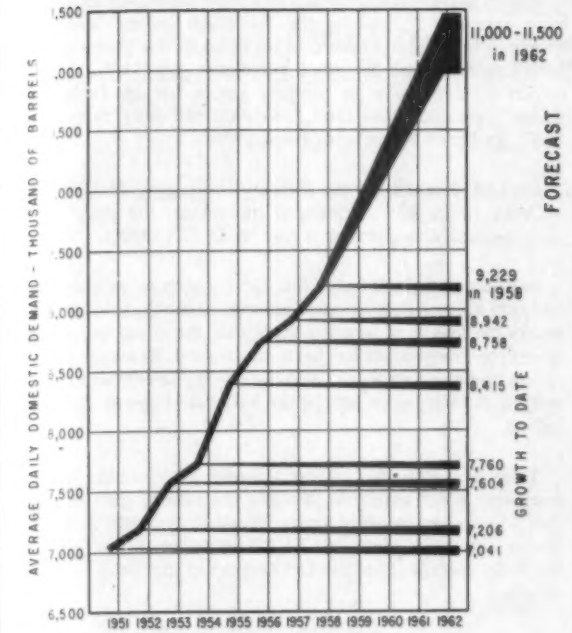

U. S. Petroleum Product Demand, 1951-1962.

for 1958— MODERATE GAINS IN DEMAND

Steady long-term growth seems assured, but refiners are feeling the competition of natural gas

Virgil B. Guthrie
Contributing Editor

SIGNIFICANT factors concerning future demand for petroleum products appear in *The Refining Engineer's* current outlook survey:

● Domestic demand for all products in 1957 will reach 8,942,000 bbl daily, about 2.1 percent above last year's 8,758,000 bbl daily. This rate of growth is much less than had been predicted at the start of the current year.

● Domestic needs will reach 9,229,000 bbl daily average in 1958, some 3.2 percent larger than the estimate for 1957. Overall rate of gain in demand is slowing down for the two-year period.

● In 1962, some authorities estimate, domestic requirements will reach between 11,000,000 and 11,500,000 bbl daily. Extent of growth within these limits depends, however, on revival of the oil heating market or large growth in demand for other distillates. Also, progress of the Federal Highway Building Program, which will stimulate motor gasoline consumption and require large volumes of petroleum products during construction, plays a key role.

● Refiners are watching the development of the new high energy "exotic" fuels for their possible use in wide-cut gasoline to provide better jet fuels.

RE's survey is based on data submitted by oil company economists and authorities in various industrial fields. Individual estimates on demand . . . specifically for 1957, by quarters for 1958, and in general for the next five years . . . have been analyzed, averaged out, and presented in the accompanying demand tables. Normal weather conditions are assumed and no allowance was made for international disturbances which could materially affect domestic or export requirements.

The relatively small gain in demand forecast for 1958 comes on top of an even smaller rate of growth in 1957. Rate of growth for the **two years** will be about 4 percent, whereas the industry in recent years gone by has experienced a 5 percent **annual** growth pattern. We're slowing down. Why?

The Slowdown Started in 1957 . . .

Study of the conditions that resulted in a lower-than-anticipated demand growth in 1957 throws some light on factors that will strongly influence growth in 1958, and possibly later. Both short-range factors — such as weather — and long term factors — such as the inroads made by natural gas on the house heating market—enter into the picture.

At the start of 1957, it was generally predicted that domestic demand would reach 9,340,000 bbl daily average, close to a 5 percent gain over 1956. Now, it's predicted that 1958 demand will be a little lower than that *originally* forecast for 1957. Some of the factors influencing the decrease in rate-of-growth were:

Last winter was warmer, cutting down heating oil consumption. Representative areas over the country experienced 10 to 15 percent fewer degree days during the 1955-56 heating season. Domestic light heating oil demand during the first six months of 1957 was about 2 percent less than the previous year.

Spring was cool and wet in the East, and there were severe storms in the Midwest, tending to hold down highway traffic and farming operations. Gasoline consumption was, of course, greatly reduced.

Slackening industrial activity, apparent early in the year, was also a deterrent to expansion of petroleum consumption.

Competition from natural gas . . . a long range factor . . . in the house heating market, along with a decrease in house building, reduced the number of oil burner installations anticipated for the 1956-57 season.

TABLE 1. Annual Demand for Petroleum Products, 1957-58. (In 1000 bbl)

	1957	1958
Domestic		
Gasoline	1,408,535	1,467,300
Kerosine	109,865	111,325
Distillate fuel oil	630,355	665,395
Residual fuel oil	559,180	522,315
Lubricating oils	43,800	44,530
All other	512,095	557,720
Total Domestic	3,263,830	3,368,585
Exports		
Gasoline	38,325	31,025
Kerosine	5,475	2,190
Distillate fuel oil	45,260	24,090
Residual fuel oil	37,230	26,280
Lubricating oils	13,870	13,870
All other	64,970	22,265
Total Exports	205,130	119,720
Total Demand		
Gasoline	1,446,860	1,498,325
Kerosine	115,340	113,515
Distillate fuel oil	675,615	689,485
Residual fuel oil	596,410	548,595
Lubricating oils	57,670	58,400
All other	577,065	579,985
TOTAL DEMAND	3,468,960	3,488,305

The largest rate of gain in 1957 . . . even higher than had been expected . . . was in the so-called "other" category shown in the demand tables. Main items in this group are jet fuels, asphalt, and liquefied petroleum gas (LPG). Due largely to expansion in military needs for jet fuels, the "other" products will total 1,403,000 bbl daily average in 1957, a gain of 3.8 percent from 1956.

Jet fuel demand by the military, averaging 260,000 bbl daily in 1957, was 20 percent more than the prior year. And, most of this demand is met by U. S. refiners.

Petroleum asphalt sales for 1957 are now estimated at 245,000 bbl per day, about 3 percent lower than 1956. This marks the first time in eight years that the climb in requirements for this product has been interrupted. Reasons: Heavy spring and summer rains delaying paving schedules in some sectors and the lag in getting the Federal Highway Program rolling.

Take of LPG, the largest volume item in the "other" category, is not expected to show the rate of gain in 1957 that was shown in other years. Weather is partly to blame. Some authorities place 1957 LPG requirements at 445,000 bbl daily average. (See the LPG report in this issue for more details.)

Increased export trade of petroleum products during 1957 was entirely due to shipments, principally of fuel oils, to Western Europe. Most of the shipments were made during the early part of the year during the Suez Canal crisis. Total exports were up 31.3 percent from 1956.

Total 1957 demand for petroleum products refined in the United States is estimated at 9,504,000 bbl daily average, 3.5 percent higher than in 1956. Exports will have totaled 562,000 bbl daily, up from 428,000 in 1956. Thus can be seen the key role that exports had in supporting 1957 refining operations.

Outlook for 1958 . . .

Slower rate of growth for distillate fuels will influence total demand for petroleum products through 1958, and longer. Important reasons are: Competition from natural gas, especially in the densely populated areas of the Midwest and middle Atlantic states; reduction in number of new houses to be built in 1958, and only a small market for coal to oil conversions. Since heating oil sales account for some 60 percent of the total distillate fuel market, effect on overall demand is notable. The Oil Heat Institute estimates that only 350,000 additional central oil burners were installed in 1957, making the total operating in the 1957-58 winter about 7,000,000.

Reduced growth in the diesel fuel market seems imminent, too. Growing rapidly during the past decade, the market is slowing down primarily because the railroads have about completed their steam locomotive-diesel electric engine conversion programs. The 1958 forecast demand for distillate fuels is 1,823,000 bbl daily average, 5.6 percent higher than 1957. This may seem high at first glance, but it must be remembered that 1957 was a relatively poor year, up only 2.6 percent over 1956 sales of distillate fuels.

Domestic demand for residual fuel oil showed a small decline in 1957 and further decrease is expected in 1958. At present residual fuel oil prices the Bituminous Coal Institute sees "a trend developing among both small and large

TABLE 2. Forecast of Petroleum Demand, 1957-58.*
(1000 bbl per day average)

	Year 1956	Year 1957	Percent change 1957 from 1956	1958 1st quarter	1958 2nd quarter	1958 3rd quarter	1958 4th quarter	Year 1958	Percent change 1958 from 1957
DOMESTIC									
Gasoline	3,748	3,859	+ 3.0	3,677	4,178	4,214	4,015	4,020	+ 4.2
Kerosine	321	301	— 6.2	454	167	199	402	305	+ 1.3
Distillate fuel oil	1,683	1,727	+ 2.6	2,574	1,319	1,200	2,196	1,823	+ 5.6
Residual fuels	1,535	1,532	— 0.1	1,810	1,409	1,285	1,675	1,431	— 6.6
Lube oils	120	120	—	120	122	123	121	122	+ 1.7
Other	1,351	1,403	+ 3.8	1,499	1,471	1,672	1,526	1,528	+ 8.9
Total Domestic	8,758	8,942	+ 2.1	10,134	8,666	8,693	9,935	9,229	+ 3.2
EXPORTS									
Gasoline	97	105	+ 8.2	81	84	89	88	85	—19.0
Kerosine	9	15	+66.7	6	6	5	7	6	—60.0
Distillate fuel oil	94	124	+31.9	61	67	67	68	66	—46.8
Residual fuels	76	102	+34.2	70	74	72	71	72	—29.4
Lube oils	38	38	—	38	39	38	38	38	—
Other	114	178	+56.1	65	64	62	61	61	—65.7
Total Exports	428	562	+31.3	321	334	333	333	328	—41.6
TOTAL DEMAND									
Gasoline	3,845	3,964	+ 3.1	3,758	4,262	4,303	4,103	4,105	+ 3.6
Kerosine	330	316	— 4.2	460	173	204	409	311	— 1.6
Distillate fuel oil	1,777	1,851	+ 4.2	2,635	1,386	1,267	2,264	1,889	+ 2.1
Residual fuels	1,611	1,634	+ 1.5	1,880	1,483	1,357	1,746	1,503	— 8.0
Lube oils	158	158	—	158	161	161	159	160	+ 1.3
Other	1,465	1,581	+ 7.9	1,564	1,535	1,734	1,587	1,589	+ 0.5
TOTAL DEMAND	9,186	9,504	+ 3.5	10,455	9,000	9,026	10,268	9,557	+ 0.6
Crude runs to stills	7,938	7,990	+ 0.7	8,141	8,009	8,197	8,295	8,135	+ 1.8

*The above data showing product demand and crude runs for 1957 and by quarters for all of 1958 are averages of individual company reports for the periods shown.

commercial and industrial users to convert oil and gas heating units to coal."

Motor gasoline outlook. Motor vehicle registrations in the U. S. reached about 67,230,000 in 1957, about 3 percent higher than 1956, according to the Automobile Manufacturers Association. This tallies up to about one vehicle for every 2.5 persons . . . close to saturation under present conditions. Further rate of growth in the number of vehicles depends on a number of economic factors such as:

Population growth,
Number of second cars in the family,
Influence of smaller cars,
Gasoline prices (and taxes),
Growth in highway transportation of goods,
Effect of highway congestion on recreational driving, etc.

Some of these influences are already being felt. Gasoline demand was up 37 percent over the five years 1947-1951, but dropped to 23.5 percent over the 1952-1956 period. Domestic gasoline demand, forecast at 4,020,000 bbl daily average for 1958, is 4.2 percent higher than presently estimated demand for 1956. Happily, this represents a gain over 1957, when demand was up about 3 percent from 1956.

Largest rate of growth in 1958 and thereafter, will be in "other" products. An increase of almost 9 percent is expected in 1958. Requirements for jet fuels are expected to reach 280,000 bbl a day and with the full-scale introduction of commercial gas turbine and jet-powered aircraft, demand will soar higher in 1959. Also, highway construction will take over 11,000,000 tons per year of refined asphalt when the Federal program gets into high gear at the end of 1958.

Export trade will drop materially, as would be expected. A decrease of 41.6 percent from 1957 is predicted, largely offsetting the modest 3.2 percent gain forecasted for domestic demand in 1958. This brings the total product demand in 1958 to 9,557,000 bbl per day average, an increase of only 0.6 percent from 1957.

What's in the Distant Future?

In this day and age, looking five years ahead might be considered "distant future." Predictions on domestic demand for petroleum products in 1962 vary from 11,000,000 to 11,500,000 bbl daily. The higher rate depends upon some market factors that have not been effective in increasing demand

TABLE 3. Refiners' Stocks, Principal Products, by Quarters 1957-58. (In 1000 bbl)

	Dec. 31, 1956	1957				1958‡			
		Mar. 31*	June 30*	Sept. 30†	Dec. 31‡	Mar. 31	June 30	Sept. 30	Dec. 31
Gasoline	187,271	206,716	190,063	177,410	186,000	207,000	186,000	174,000	208,000
Kerosine	31,420	20,223	28,872	36,093	31,000	22,000	31,000	37,000	32,000
Distillate fuel oil	133,981	76,245	117,364	170,133	141,000	78,000	123,000	168,000	139,000
Residual fuels	44,491	37,371	45,572	57,882	52,000	44,000	50,000	56,000	51,000
Total above	397,163	340,555	381,871	441,518	410,000	351,000	390,000	435,000	430,000

*Actual Bureau of Mines.
†API Data.
‡Forecast.

during the two current years. For example, the Chase Manhattan Bank (New York) looks for further expansion of the distillate heating oil market during the next decade. They think that most of the urban areas, where gas can compete more successfully with oil, have been penetrated. New markets for fuel oil will open up, they expect, in the rapidly growing suburban areas. Others believe, however, that LPG will come into greater use for space heating in suburban United States areas.

Low-cost air conditioning may expand . . . and tend to level out . . . the market for distillate fuels by creating summer demand. At least one large oil company (Esso Standard) is studying this potential market. Diesel fuel, one of the distillates, will continue to grow at an annual rate of about 5 percent. Growing use of diesel fuel in automotive equipment, which displaces an equivalent volume of motor gasoline, is one of the main reasons.

The new highway construction program will create a sizable market during construction phases and the new highways will, in turn, stimulate gasoline consumption. The National Highway Users Conference, Inc. estimates that contract awards in 1958 will require 5,500,000 bbl of all types of petroleum products and that these needs will reach 12,000,000 bbl by 1960. This is exclusive, of course, of asphalt used in actual construction.

Jet fuel requirements will grow substantially during the next five years. It's expected that military needs will reach around 330,000 bbl daily. One authority estimates that by 1962, there will be more than 800 turbine-engine and jet-powered commercial transports in the international airlanes, with their fuel demand being more than 200,000 bbl per day . . . much of it to come from the U. S.

Thus, while the rate of growth in demand for petroleum products may not be as great during the next five years as experienced during the past decade, considerable new facilities will be required to meet the increased refining, transportation, and marketing load.

Technological Influences on Fuel Demand . . .

Rapid developments now occuring in the search for rocket fuels in our military program hold important possibilities for the petroleum industry as the principal supplier of fuels for creation of mobile energy. These developments could be along three lines:

- Increased future manufacture of liquid and solid-type high energy fuels (HEF).
- A change in the nature of present jet fuels, by adding HEF components that would in part supplant the present all-petroleum fuels.
- Development of new high-energy components or additives for aviation gasoline.

Ethyl Corporation has developed a compound that materially improves the performance number of aviation gasoline, and there's good reason to believe that some work has been done on HEF components in standard jet fuels. A possible fourth factor, use of HEF only in military jets . . . instead of mixing HEF components with petroleum fuel seems unlikely due to high cost involved.

So-called "exotic" high energy fuels will be in small demand as compared with volumes that oil companies are accustomed to handling. However, they will carry a very high intrinsic value for some years. Already, $1 per gal is being mentioned as the price for the boron-type liquid fuel now being produced semi-commercially by Olin Mathieson Chemical Corporation at Niagara Falls.

Other rocket or missile fuels based on petroleum products include kerosine and analine, both of which can use fuming red nitric acid as the oxidizer. These combinations are not the ultimate, in all probability, because two separate fuel tanks are required. Most desirable is a self-oxidizing fuel, either liquid or solid, with safe handling characteristics and relative economy in manufacture.

The petroleum industry has two direct stakes in the development of high energy fuels; first, as a possible manufacturer, and second, the effect that these developments may have on all-petroleum products.

ACKNOWLEDGMENT . . . This nation-wide survey was made possible by the cooperation of leading petroleum refiners, marketers, and agencies throughout the country. We want to acknowledge the help of the following companies, plus several others who politely declined mention:

American Petroleum Institute
The Asphalt Institute
Atlantic Refining Company
Chase Manhattan Bank
Cities Service Oil Company
Continental Oil Company
National Highway Users Conference
The Ohio Oil Company
Phillips Petroleum Company
Pure Oil Company
Sinclair Refining Company
Socony Mobil Oil Company
Standard Oil Company of California
Sun Oil Company
U. S. Bureau of Mines

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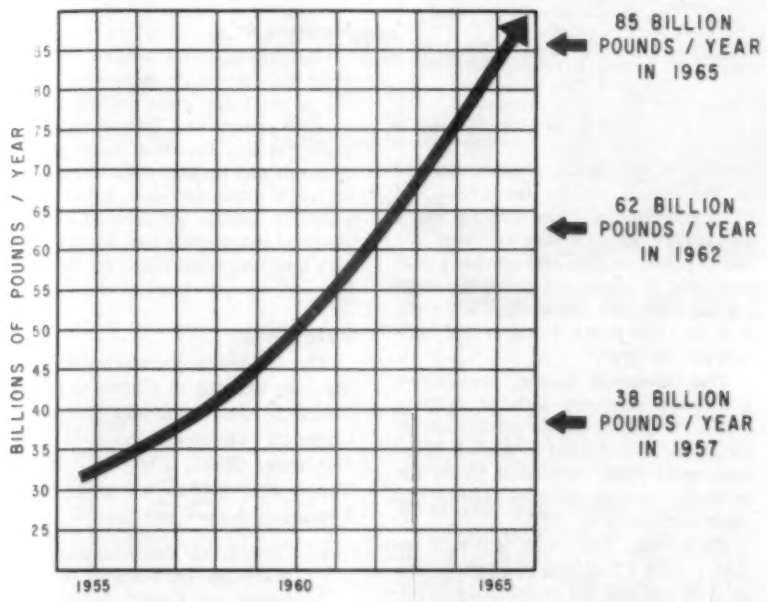
U. S. PETROCHEMICALS GROWTH 1957-1965



The experts say that the industry will double in the next eight years

Donald M. Taylor
Gulf Coast Editor

THE PETROCHEMICAL industry will more than double by 1965 according to its leaders who met in Houston, Texas, late in November.

Markets for petrochemical products are soaring, and the only uncertainties clouding the industry's future are possible shortages of raw materials and competition from abroad.

W. E. Kuhn, general manager, Research and Technical Department of The Texas Company predicts that this industry which produced an estimated 38 billion lb of petrochemicals in 1957 will produce 85 billion lb in 1965![1]

Lending credence to this rosy-hued view of the future is the fact that the petrochemical industry as a whole is as adaptable as a sailor on shore leave. Every year companies switch piping around or build new units to produce new end products to keep up with changing markets, feed stocks and processes.

As the manager of one of the largest plants on the Gulf Coast put it, "I know what we are manufacturing today, but I do not know what we will be manufacturing by the end of the year. The one certainty is that the list of products we manufacture will be altered sharply during any 12-month period."

This training in the art of being fast on the feet leaves little room for doubt that the industry will solve most of the problems that lie in the immediate future. With a world market hungry for plastics, wonder-fibers, solvents, synthetic rubber, etc., the greatest difficulties in the years ahead will likely come in supply of raw materials for petrochemical manufacture. About 50 percent of these "raw" materials are by-products from refineries; the remainder are comprised of natural gas and LP-Gas.

Supplies of Natural Gas and LP-Gas

Chances are, the price of both natural gas and LPG will advance moderately, keeping up with the laws of supply and demand. Trend is definitely upward for natural gas. During the past eight years, the cost of gas at the wellhead in Louisiana has advanced from an average of about 10 to 20 cents per Mcf, and during the same period, gas on the Gulf Coast of Texas has advanced from 7 to 16 cents. We can reasonably expect further increase of 5 to 10 cents per Mcf by 1965.[2]

LP-Gas should be plentiful in 1965 — the sales in 1956 ran 6.6 billion gal, yet production was 8.5 billion gal, or 1.9 billion gal in excess of consumption. Southwest Research Institute has estimated LP-Gas sales at 9.8 billion gal in 1965 and if present trends continue, about 30 percent of this amount will go into chemical manufacture.[2]

Supplies of Refinery By-Products

Sources of supplies from refinery runs will fluctuate as refinery economics, crudes, and markets vary. If the present high octane race continues, there will likely be increasing competition for light hydrocarbons, particularly unsaturates and hydrogen.

For a better picture of the changes ahead in our supplies of by-product raw materials, see Table 1.

Availability of by-product hydrogen. Biggest and most important source of H_2 is the catalytic reformer. If today's

TABLE 1. How Processing Trends Will Affect Petrochemicals.[1]

Refining operation	Increase 1954/56	Predicted trend	Effect on petrochemical raw material supply
Thermal cracking	—4.8%	Slight decrease	Reduction in light hydrocarbon unsaturates.
Catalytic cracking	21.6%	Increase	More light hydrocarbons due to increased conversion.
Catalytic reforming	120 %	Increase	More light hydrocarbons due to increased conversion.
Extraction	—	Increase	More normal paraffins—compete for aromatics.
Alkylation	20.3%	Increase	Compete for light hydrocarbons—isobutane and C_3, C_4 and C_5 olefins.
Polymerization	13.4%	No major change	Compete for light olefins.
Isomerization	—	Increase	Isobutane for alkylation—C_5 and C_6 for high octane.
Hydrogenation	580 %	Increase	Compete for hydrogen—higher H_2S availability.

trend continues, reforming capacity should more than double by 1965 — but at the same time there will be increase needs for by-product hydrogen in refinery operations. In 1956, this nation's reforming capacity was 1.24 million bbl per day, and by 1965 this will probably have increased to 2.6 million bbl per day.[2] Today's yields of 500 to 700 cu ft of H_2 per bbl processed will push the 1965 production toward the 2 million cu ft per day mark.

How will this hydrogen be used? Primarily for the desulfurization and upgrading quality of feed stocks, improving storage stability, color, odor, and other qualities of finished products and in the manufacture of high grade gasoline components.

Its chief petrochemical use will be for ammonia production. Ammonia plants based on catalytic reformer hydrogen are cheaper to build than those based on natural gas, fuel oil, or coke. Other petrochemical processes such as hydrogenation of benzene to cyclohexane will continue to grow.[3]

Aromatics. As in the case of by-product H_2, the principal source of aromatics — especially benzene, toluene and xylenes — is the catalytic reformer. Benzene is used in the manufacture of styrene (polystyrene plastics and synthetic rubber), phenol (for phenolic resins, etc.), nylon and dodecylbenzene (synthetic soaps). In 1956 the total supply was approximately 370 million gal of which 199 million came from coal sources, 114 million gal from petroleum sources and 57 million from imports.[3]

R. F. Pfennig,[2] section head of Technical Services, Humble Oil & Refining Company, predicts that by 1965 this country will be using a total of 500 million gal of benzene.

Toluene will also show a sharp increase by 1965. In 1954 the consumption pattern for this product was 13 percent for explosives, 46 percent for aviation gasoline, 13 percent for chemical synthesis, 22 percent for protective coatings and solvents, and 6 percent for miscellaneous uses. Major demand in the future will be for avgas and chemical synthesis. The use of toluene in making toluene diisocyanates for use in polyurethanes and synthesis with acetylene to make polymethyl styrene promises growth. Consumption for the U.S. in 1965 is estimated at 335 million gal per year.[3]

The symetrical isomer, paraxylene, is another aromatic with an exciting future. It is used in the production of terephthalic acid used in dacron fibers and mylar films. See Table 2 for the estimated consumption of xylenes and other aromatics in 1965.[3]

Propylene. The petrochemicals industry used 1.5 billion lb of propylene in 1956 and will use an estimated 2 billion lb in 1965.[4] Its primary uses are in the manufacture of isopropyl alcohol and its by-products; and the use of propylene trimer and tetramer as basic raw materials in the manufacture of plasticizers, nonyl phenol and dodecyl benzene, a detergent base stock. It is also used in synthetic glycerine production. The wide variety of resins and coating materials based on glycerine and allyl chloride should contribute to a healthy growth in the next few years.

Propylene is making its entrance into the plastics field. For example, a polypropylene plant with a capacity of 20 million lb per year recently went onstream at Hercules Powder Company's Parlin, New Jersey, plant.

Butylene, used as a feedstock in the production of butyl alcohol and its derivitive, methyl ethyl ketone, and in butadiene production, will be in plentiful supply in 1965.

Ethylene, one of the mainstays of the petrochemical industry, will be in plentiful supply in 1965. It is normally a by-product of refinery operations and can be produced from ethane and propane extracted from natural gas. John G. McLean, vice president of Continental Oil Company has estimated that its production on the Gulf Coast could easily reach 12.5 billion lb by 1965 if the demand is sufficient.[2]

Manpower

One of the great problems that must be solved by the petrochemical industry to meet the great expansion program is manpower. Requirements for highly skilled technical men and for research and process men will be hard to meet. However, our nation's new program aimed at encouraging the study of engineering and science might go a long way toward solving this problem in the years ahead.

References

The following papers presented at the joint meeting of Chemical Market Research Association and Commercial Chemical Development Association, November 20-21, 1957, in Houston, Texas, were used in compiling the information above:

1. "Trends in Petrochemical Raw Materials—A Forecast of Availability and Cost," W. E. Kuhn, general manager, Research and Technical Department, Beacon, New York.
2. "The Gulf Coast Petroleum Industry in 1965," John G. McLean, vice president, Continental Oil Company, Houston, Texas.
3. "Gulf Coast Chemical Industry in 1965 — A Forecast of Hydrogen and Aromatic Hydrocarbons Requirements," remarks made in panel discussion by R. F. Pfenning and L. Karvelas, Humble Oil & Refining Company, Technical and Research Divisions, Baytown, Texas.
4. "Hydrocarbon Requirements for Chemical Manufacture," remarks of H. A. Mitchell, Shell Chemical Corporation, New York.

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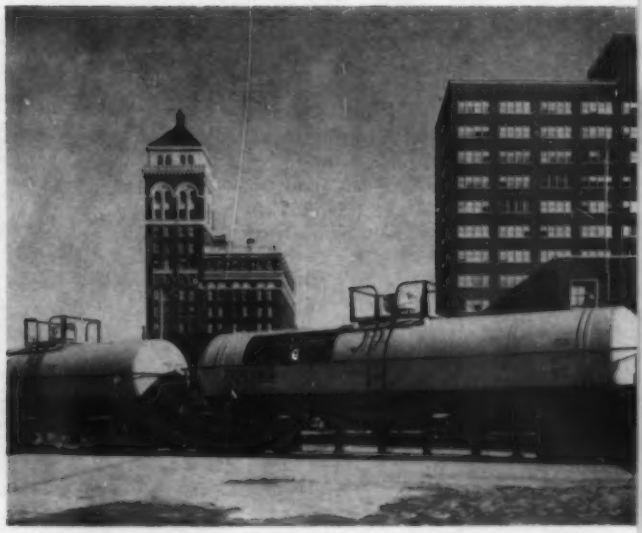
TABLE 2. Future Demand for Aromatics.

	Forecasted U. S. demand in 1965	Total supply		Supply from Gulf Coast area
		From coal	From petroleum	
Benzene	500	220	280	200
Toluene (total)	335	50	285	155
C_8 aromatics	300	20	280	150
Orthoxylene	17.5	—	17.5	7-10
Naphthalene	68	68	—	—

FIG. 1. New uninsulated tank cars, first placed in service in 1957, are reducing transportation costs.



1957 LP-Gas Sales Up 4.1 Percent

Geo. R. Benz[1]
W. F. DeVoe[2]
and Paul W. Tucker[3]
Phillips Petroleum Company
Bartlesville, Oklahoma

LP-GAS SALES during 1957 appear to have increased by 272,000,000 gal over the 1956 total. While this increase is lower than the LP-Gas industry has shown in recent years, it does exceed the estimated percentage increase in sales of all other petroleum products this year.

Gains in motor fuels and domestic use are especially impressive, while the drop in gas manufacturing resulted from extension of gas pipelines and reduced peak shaving demand. Indications are that 1958 will be an even better growth year than 1957.

[1]Manager, Engineering Department.
[2]Manager LP-Gas Sales, Sales Department.
[3]Technical Representative, Engineering Department.

Domestic and Motor Fuel

It is estimated that the domestic and motor fuel market for LP-Gas in 1957 totaled 3,943,300,000 gal. This is a 4.5 percent or 168,800,000 gal increase over 1956. The most important factor in domestic growth continues to be house heating as more people demand the convenience of modern gas heat. As natural gas distribution facilities are expanded and extended some heating loads are lost, but in practically all cases the net result is a gain due to more people becoming "gas conscious." The swing to central heating was more pronounced this year and "year-around weather conditioning" with gas represents a hugh potential market still to be tapped.

Agricultural use of LP-Gas continued to expand in spite of an extremely wet growing season and floods in many sections of the nation. Crop drying increased tremendously in many sections this year and offered an opportunity for many dealers to increase their summer LP-Gas load as they make more farmers aware of its advantages. Use of LP-Gas in flame weeding and flame cultivation continues to grow as more and more dealers recognize its possibilities as a summer load builder. It is estimated that sales of flame weeding equipment are up 30 percent this year.

Motor Fuel

It is estimated that 7.9 percent more LP-Gas was used as motor fuel in 1957 than in 1956. This is an increase of 61,000,000 gal and makes the estimated total 834,500,000 gal.

Largest volume users of LP-Gas motor fuel are irrigation pump engines,

Domestic and Motor Fuel — Up 4.5 % to 3,943,300,000 gallons
Industrial and Miscellaneous — Up 1.4% to 668,900,000 gallons
Gas Manufacturing — Down 4.2% to 203,500,000 gallons
Chemical Manufacturing — Up 6.0% to 1,665,500,000 gallons
Synthetic Rubber — Up 2.0% to 426,500,000 gallons
Total LP-Gas Usage — Up 4.1% to 6,907,700,000 gallons

farm tractors and drilling rigs. Heavy rainfall during the growing season in the principal irrigated areas of the Great Plains states along with reduced drilling activity resulted in a substantial drop in fuel consumption for these two uses. The fact that, in spite of this drop, the total volume of LP-Gas used for motor fuel exhibited a healthy increase testifies to the tremendous growth of other engine fuel uses.

The number of factory equipped LP-Gas farm tractors produced in 1957 is estimated at 15,500 — 27 percent higher than in 1956. This increase is particularly significant in view of the fact that gasoline fueled farm tractor production is down about 7 percent this year. LP-Gas fueled tractors now represent about 5.5 percent of total tractor production.

About 45,000 farm tractors were converted to LP-Gas during 1957, bringing the total number of farm tractors using LP-Gas in the United States to an estimated 368,000 units.

A majority of the new irrigation pumps being installed are LP-Gas powered and many existing units are being converted to LP-Gas, although natural gas continues to make inroads on this load in the gas producing areas.

Fastest growing segment of the LP-Gas motor fuel market is still industrial tractors and lift trucks. A high percentage of new units are now factory-equipped for LP-Gas motor fuel. Over 40 percent of the LP-Gas carburetor production (excluding farm tractors) is for lift trucks and industrial tractors.

The number of highway vehicles fueled by LP-Gas continues to increase although only a few of the long distance haulers have, as yet, converted their fleets. Many fleets are running comparative tests with other fuels at this time.

LP-Gas dispensing facilities are being installed at more and more service stations to serve this rapidly expanding market.

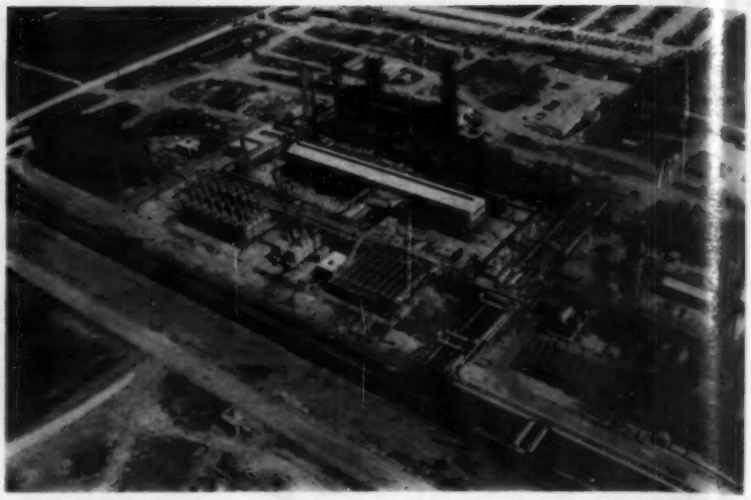


FIG. 2. New chemical plants using LP-Gas as feedstock increases demand, stabilizes seasonal load fluctuations.

Appliances

Sales of LP-Gas appliances and equipment during 1957 lagged behind the highs of 1956 because we are now in a period which has seen a drop-off in all durable goods. However, in the overall appliance and equipment field, LP-Gas appliance and equipment sales were holding their own or above the average.

Domestic LP-Gas range sales are estimated at 394,000 units — 20 percent of all domestic gas range sales. Automatic LP-Gas water heater sales are expected to be 304,200 which is over 12 percent of all automatic gas water heaters. Warm air furnace sales are estimated at 720,000 of which approximately 10 percent (72,000) were for use with LP-Gas. Of the 160,000 conversion burners, 3.6 percent (5800) were expected to be for LP-Gas. Sales of LP-Gas direct heating equipment and vented recessed wall heaters should reach 405,800 units. LP-Gas floor furnace sales are estimated at 25,500 or 27.7 percent of all gas floor furnace sales.

Industrial and Miscellaneous

LP-Gas used in industrial and miscellaneous applications during 1957 is estimated at 668,900,000 gal — up 1.4 percent or 9,200,000 gal over 1956. Increase in this category was held down by the "leveling-off" trend in industrial activity this year. However, this demand could be increased considerably by a severe December. Use of LP-Gas in asphalt aggregate drying is gaining wider acceptance as highway construction increases. This application is an excellent potential load builder for many dealers.

Gas Manufacturing

Use of LP-Gas by gas utilities in 1957 is estimated at 203,500,000 gal, which is a decrease of 4.2 percent or 8,800,000 gal from 1956. This decrease is due to expansion and extension of natural gas pipelines. Utility demand

Marketed Production of LP-Gas.

Year	Gal (in thou)	Percent increase	Domestic and motor fuel*	Percent increase	Industrial misc.	Percent increase	Gas Mfg.	Percent increase	Chemical Mfg.	Percent increase	Rubber components	Percent increase
1945.....	1,276,766	20.4	533,262	19.7	256,577	0.8	53,849	17.4	224,291	47.5	208,787	28.8
1950.....	3,482,567	22.8	2,022,464	24.3	355,456	(1)	251,694	5.2	624,468	14.6	228,485	28.5
1951.....	4,227,275	21.4	2,456,804	21.6	269,408	(1)	281,692	11.9	844,507	35.2	374,864	64.1
1952.....	4,477,379	5.9	2,636,736	7.4	338,959	26.0	259,697	—7.8	870,990	3.1	370,997	— 1.1
1953.....	4,932,009	10.2	2,977,418	12.9	374,233	1.04	222,430	—14.4	967,427	11.1	390,501	5.3
1954.....	5,125,533	3.9	3,174,012	6.6	401,615	7.3	191,932	—13.7	1,050,239	8.6	307,735	—21.2
1955.....	5,996,483	17.0	3,453,200	8.8	556,371[2]	38.5	213,760	11.4	1,366,942[3]	30.2	406,210	32.0
1956.....	6,635,763	10.6	3,774,492	9.3	659,730	18.6	212,293	— 0.7	1,571,147	14.9	418,101	2.9
1957.....	6,907,700	4.1	3,943,300	4.5	668,900	1.4	203,500	— 4.2	1,665,500	6.0	426,500	2.0

*Household use plus other requirements by these customers such as irrigation pumping, tractor fuel, flame weeding, chicken brooding, and similar uses. Included also is LP-Gas sold by domestic distributors but used for industrial purposes. Included also, in years following 1950, is LP-Gas sold direct by producers and marketers solely for fueling internal combustion engines.

[1] Not comparable due to change in method of reporting LP-Gas sold for refueling internal combustion engines.

[2] Includes more complete coverage of refinery fuel.

[3] Includes more complete coverage of LP-Gas mixture streams containing ethane and methane.

REMARKS: In this table total sales and distribution for all years except 1957 were obtained from U. S. Bureau of Mines reports. All other volumes were estimated by the writers. Total sales volume includes all LP-Gas (propane, butane, and propane-butane mixtures) when sold as such. Until 1944, the sale of pentane when sold for any purpose other than motor fuel blending was included. Since then it has been excluded. It does not include butane when blended with heavier petroleum fractions for motor gasoline purposes. Inter-company sales transactions such as purchases of LP-Gas by one company from other companies and resold as LP-Gas have been eliminated in order to avoid duplication of sales figures.

for LP-Gas is primarily determined by the severity of the weather. An unusually severe winter in some areas can quickly change the demand for LP-Gas. Gas distribution utilities continue to show a strong interest in underground LP-Gas storage facilities. Preliminary work has already started on one such mined LP-Gas storage installation in the Great Lakes region.

Chemical Manufacture

Sale of LP-Gas as a raw material for the manufacture of chemicals and chemical intermediates gained at a somewhat lower rate than during the previous two years, due primarily to general business conditions. However, the operation of new facilities in the Gulf Coast and western Texas area, some of which were started up in late 1956, resulted in a gain of 6.0 percent or 94,400,000 gal, to a total of 1,665,500,000 gallons for the year.

Most of the increase was due to the rapid growth in polyethylene capacity, with a number of plants coming onstream during 1957. Other polyolefin plastics or elastomers, such as polypropylene, polybutylenes and polybutadienes, received considerable attention but remained largely in the development stages.

Butadiene plants, especially those using normal butane as a feed stock, are becoming important producers of petrochemicals other than synthetic rubber components, since their operation can easily be modified to yield increased recovery of butylenes and propylenes.

Synthetic detergents used increased quantities of propylene obtained mainly from rich refinery gas streams, and the use of LP-Gas in the production of intermediates for synthetic fibers also increased. Large volumes of LP-Gas were used to make intermediates for the manufacture of styrene, an important component of synthetic rubber.

Nitroparaffins, acetylene, hydrogen, phenols, glycols, amines, acetones, various motor fuel and lubricating oil additives and alcohols are smaller but growing chemical products using LP-Gas components as a raw material.

A small but interesting and growing application is its use as a propellant in aerosol type containers.

Rubber Components

Use of LP-Gas in manufacturing synthetic rubber components during 1957 is estimated as 426,500,000 gal. This is an increase of 2 percent or 8,400,000 gal over 1956. The actual total might be higher if it were possible to clearly distinguish between that going into manufacturing synthetic rubber and that used as chemical feedstocks. U. S. consumption of synthetic rubber was up about 8 percent over 1956. Production increased only 2 percent because producers and consumers both reduced inventories during the first half of 1957. In addition, one major synthetic rubber producer was shut down for an extended period by a strike.

It is interesting to note that the plant capacity for making GR-S has increased nearly 55 percent in the two years since the ownership of the plants changed from the government to private industry. In 1956 the ratio of synthetic to natural was about 60:40, whereas in 1957 the ratio appears to be even better than 63:37.

Supply

In 1957 there were 32 new plants added, with an estimated production capacity of 1,200,000 gal per day. This additional capacity along with that resulting from expansion of existing plants was sufficient to offset the lower production from some plants, part of which was due to curtailed allowables. It is currently estimated that 23 new plants having a production capacity of nearly 1,500,000 gal per day will be added in 1958. A recent National Petroleum Council report indicated that the LP-Gas production could be nearly doubled in the event of a national emergency — assuming no proration of crude oil and natural gas production.* A new Canadian plant came onstream in 1957 and others are proposed for 1958.

LP-Gas storage capacity in both conventional aboveground steel storage tanks and underground storage installations continues to increase. It is estimated that the available underground storage capacity now totals close to 1,400,000,000 gal, and that there is an additional 400,000,000 gal planned or under construction.

A new aspect of LP-Gas storage capacity has been introduced this year, the miscible displacement of crude oil. It involves the injection of LP-Gas followed by lean gas and in some cases subsequently followed by water. While referred to here as another type of storage, it can easily be considered another use in that the LP-Gas is essentially "stored" underground while used in this process. It is not known as yet what the recovery of LP-Gas will be and in most instances it will be necessary to reprocess it before it will be marketable as LP-Gas. Volume involved is indefinite but several companies now have projects underway and with the interest currently being shown it could become an important factor in the LP-Gas storage and supply picture.

*See "U. S. Could Nearly Double LPG Production," page C-30 *The Refining Engineer*, November 1957.

Transportation

Expansion of LP-Gas transportation facilities continued during 1957. One new interstate LP-Gas pipeline went into operation in addition to several short pipelines to carry feedstock to chemical plants. Several pipelines went into operation carrying natural gas liquids, one pipeline is being considered for products service (including LP-Gas), and two railroads have undertaken a joint study to determine the feasibility of constructing an LP-Gas pipeline along their right-of-way.

It is estimated that 23,000 tank cars were in LP-Gas service during the peak demand season.

A large new sea-going barge and one new tanker entered LP-Gas service in 1957, operating primarily in the Caribbean. A large tanker is under construction which will haul butane-propane mixtures from Venezuela to the East Coast. Barge movements on the Mississippi increased with four new barges being placed in service and two more planned. A new barge terminal in Georgia was also scheduled to be in operation late in 1957 or early 1958.

Trend to larger (10,000 gal) highway transport units continues. Volume of LP-Gas moving by highway is growing steadily.

Safety Development

The industry "bible," National Fire Protection Association Standard No. 58 covering the Storage and Handling of Liquefied Petroleum Gases, was again revised, as was NFPA Pamphlet No. 59, to keep pace with new developments in equipment and safe operating techniques in a continuing effort to improve the already enviable safe record. Additionally, the new API bulletin No. 2510 covering the design and construction of LP-Gas storage installations in refineries, natural gasoline plants and marine and pipeline terminals was completed and issued.

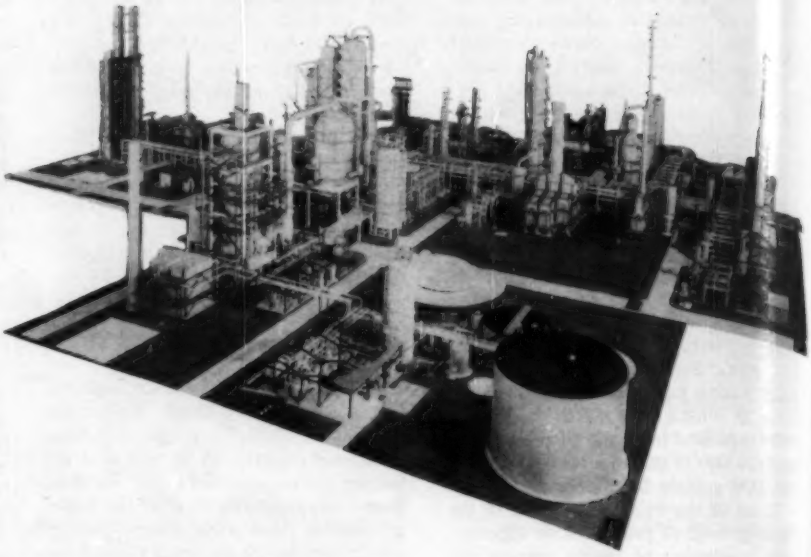
Outlook

While the LP-Gas industry exhibited a better growth than the petroleum industry in general and the nation's economy as a whole, it can do better. There are still many potential "load builders" to be developed. The industry winter to summer ratio has been increasing. By pushing summer "load builders" like crop drying, flame weeding, asphalt heating, aggregate drying and tractor fuel, dealers will be in a better position to capture and expand the house heating load. Gas air conditioning still represents a tremendous potential load yet to be tapped.

By developing new fuel loads, utilizing modern business practices, and by effective selling methods the industry should do even better in 1958. ★ ★

Here's how Sohio designed and justified a . . .

Proposed Integrated N·U Plant



Detailed economic studies, described here, led to the decision to replace outmoded refining units with the $40,000,000 plant shown above. In addition to determining the proper location for additional processing capacity, one of the biggest questions Sohio had to decide was integrated vs conventional process flow

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IN THE FALL of 1956, Sohio's management announced a decision to build a new refinery at Toledo, Ohio, which would essentially mean abandonment of all existing facilities. Still used in the new plan are the alkylation units, crude naphtha stabilizer, and rerun unit. Since then many people have questioned how this could be justified. This article will present the background behind this decision and explain the line of reasoning that led Sohio to this decision.

Planning Approaches; Timing of Installation

In developing future facilities plans there are several possible approaches which can be taken. Additionally, there are some variations possible for each approach. To describe these approaches reference will be made to what we refer to at Sohio as a "Timing of Installations" (T of I) chart. Fig. 1 shows such a chart for one product (gasoline) with one planning approach indicated.

Line FG on Fig. 1 indicates the forecast gasoline demand which gradually increases throughout the time period. The octane requirement, also increasing throughout the period, is shown by line HI. The saw-tooth curve ABCD — above the gasoline demand line indicates the effect of one planning approach — that of step-wise installation of facilities and always staying in a position to meet demand.

Point A on the curve represents the ability to manufacture gasoline at the corresponding octane on curve HI. Let's assume that this point represents the manufacturing ability with the facilities presently installed. As the gasoline octane requirement increases, the ability to make gasoline decreases along line AB. This is caused by the decrease in the yield of high octane blending stocks as severity is increased to obtain higher quality stocks. At point B another facility is put onstream and the potential immediately rises to point C. Then as octane requirements continue to increase manufacturing potential falls along line CD . . . etc.

This approach has the advantages of:

(1) Spreading capital requirements over a relatively long period of time (easy payment plan);

(2) being in a position to always be able to meet demand, and

(3) the ability to take advantage of small spot wholesale opportunities a large portion of the time.

It has the disadvantages of:

(1) Having portions of capital earning less than the desirable return when less than potential is manufactured (or, in general, manufactured and sold at wholesale prices), and

(2) the possibility of ending up with refineries that "grew like Topsy" if great control is not exercised.

Another possible planning approach is illustrated by the curves described by points A, B^1, C^1, D^1, etc. This approach differs from that previously described in the time at which processing facilities are installed. Here, the ability to produce is allowed to fall below demand for some amount of time prior to the installation of new facilities. The advantages of this approach are the same as for the previous and a further deferral of capital expenditures is possible at the sacrifice of ability to produce. Disadvantages include all of those previously mentioned with the additional one of being unable to meet product demands during some periods. Depending on the length of these periods, the disadvantage could be major or minor.

"Bold Step" Planning

Fig. 2 graphically depicts another planning approach which we shall call the "bold step" approach. The coordinates and curves FG and HI are the same as for Fig. 1. In this approach,

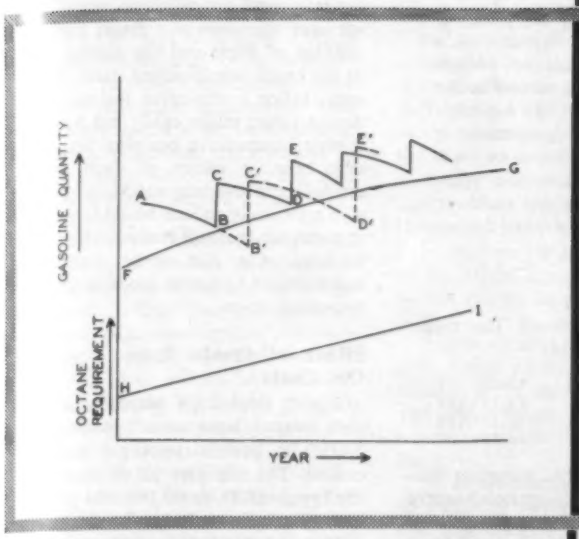

FIG. 1. Timing of installations chart step-wise approaches.

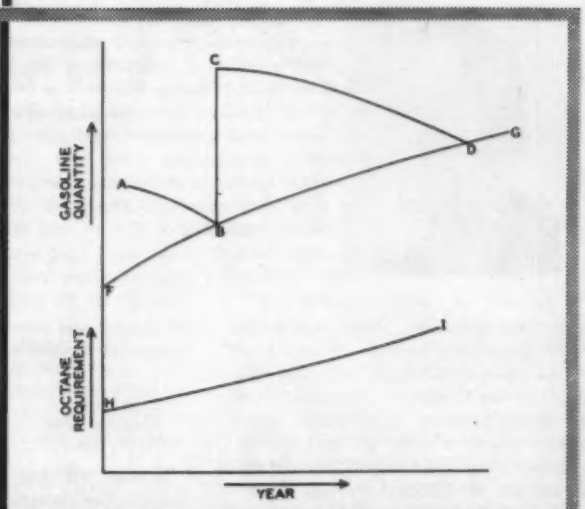

FIG. 2. Timing of installations chart bold step approach.

as the ability to produce approaches the demand at point B, a bold step of installing a complete new refinery is taken and as is evident the ability to produce jumps considerably to point C. The producing ability then falls off along line CD much as in the step-wise approaches but probably at a lesser rate since the new facility is a larger portion of the total facilities.

This approach has the disadvantages of:

(1) Requiring a large capital outlay at one time and,

(2) risking a lower than normal return on the capital investment if the facilities cannot be used to somewhere near their maximum capability.

On the other hand, it can offer the advantages of:

(1) The ability to take advantage of wholesale sales opportunities that may arise and,

(2) having a new, well-designed and planned refinery which offers operating flexibility and opportunities to decrease manufacturing costs per barrel of crude processed.

Depending on the position in which the refiner finds himself, it is conceivable that the potential savings in operating costs can overbalance the effects of a single large capital outlay and the possibility of not immediately realizing the maximum return from full utilization of the capacity. Another point worth considering in this regard is the effect of crude quality. This will be discussed in detail later but let it suffice to say for now that facilities built decades ago might well not meet the requirements of today if crude sources have changed to any major degree.

New Refinery Planning

When starting from scratch to plan a new refinery there are two main thoughts that race through your mind — tumbling one after the other. First, there is the tremendous challenge of the opportunity to create something that is going to have a major effect on company operations for many years. Second, there is the great enormity of the job, which can be boiled down into six major categories (considering only facilities planning):

1. Location,
2. Crude to be used for design,
3. Product mix,
4. Process lineup,
5. Degree of integration,
6. Refinery size.

It's very simple to list these steps as separate entities and in an orderly list, but a little reflection will reveal that many of these factors are not mutually exclusive. However, our experience was that this is much like a crossword puzzle. It took a lot of hard work to get some of the key words—but once they were filled in, the others started falling in place with comparative ease. Again, these factors might not all apply to every refiner. For example, a refiner having a large supply of captive crude might not want to or have to consider crude as a design basis. However, a refiner such as Sohio, who buys a major portion of the crude processed, can ill afford to overlook opportunities which might present themselves from proper choice of facilities to process economically attractive crudes.

Additionally, a refiner buying crudes is somewhat at the mercy of the whims of the market and can find himself "way out in left field" if he has designed for a light sweet crude, for example, and is faced with the necessity of processing a heavy sour crude. The example chosen is extreme to be sure, but it illustrates the point. Let's now consider, in order, the categories mentioned.

Location

Sohio undertook to answer the question of location of the new refinery on a completely open-minded basis. Not only were several locations in Ohio studied, but also locations out-of-state, such as the East and Gulf Coasts. In an approach of this sort care must be taken to reflect the full charge for all assets committed to the study. For example, in studying Toledo as a location, the value of all existing assets that were used were charged as part of the investment so as not to unfairly favor the Toledo location. Items in this category included such things as:

1. Land,
2. Usable tankage,
3. Office buildings, shops, etc.,
4. Docks and loading facilities,
5. Waste disposal facilities,
6. Utilities systems.

In all cases in placing a value on the asset, the most realistic alternate use value was used. Thus, in some cases the asset was valued at fair market value (when it was realistic to assume that the asset could be disposed of in the open market). In other cases, amounts equal to depreciated replacement value, book value, or even zero were used.

A significant factor in comparing refinery locations is the type of crude processed. In studying the locations the obviously unfavorable cases were not considered, but all of the favorable possibilities were considered. For example, who can say on the surface whether an East Coast or several pos-

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sible Ohio locations would look better when processing foreign crude. In all of the cases it is readily apparent that the decision cannot be reached based on manufacturing department economics solely. Crude oil purchasing, transportation, and marketing departments are all affected in varying degrees by all of the possible locations.

In analyzing the different locations, therefore, charges were made to reflect the capital requirements and operating costs incurred by other departments. In addition to the capital and operating differences that can be calculated, there are many intangible factors that have to be weighed before any decision can be made. These factors would include not only those with immediate effect but also those with potential future effect. Some of these factors are:

1. National political situation
   a. Crude imports,
   b. Dispersion for national defense.
2. State and local political situation
   a. Taxes,
   b. Public relations,
   c. Expandibility,
   d. Waste disposal.
3. Future crude oil supply.
4. Labor available.
5. Sales potential (including petrochemicals).

After all of the tangible and intangible factors had been weighed the following conclusions were reached:

1. Domestic crude (Canadian or Texas) — Toledo was the most attractive location.

2. Middle East Crude — No significant difference between Ohio and East Coast locations.

3. South American Crude — Lower operating costs at Toledo out-weighed increased capital when compared to a Gulf Coast location.

With these three conclusions in hand, the location study could be summarized with the statement that everything that was looked at indicated the Toledo location to be at least equal to and sometimes better than the other locations studied.

Crude Basis

In determining the crude type to be used as a design basis, a broad range of crudes was considered. The major categories studied were:

Light Sweet	37-42°API
Light Sour	34-37°API
Medium Sour	30-34°API
Heavy Sour	24-30°API

It was felt that this grouping presented a fine enough distinction to serve as a basis for determining the general crude type which should be used for a design basis. At this stage of the game only one factor had been decided, a Toledo location. It was therefore necessary to make the three following major assumptions in order to make these studies:

1. There would be no requirement for lubes at the new refinery since our existing capacity could supply the requirements forecast until the time another major expansion would be necessary.

2. There would be no geographic limitations on the crude oil that could be processed.

3. A consistent process lineup would be used for all crudes considered. This lineup would include crude distillation, coking, catalytic cracking, catalytic reforming, alkylation, catalytic polymerization, treating and necessary auxiliaries.

The first two assumptions are entirely logical, particularly considering the long range nature of new facilities. The third assumption would perhaps to some extent penalize unusual crudes where some other process might better qualify for one crude than another. However, in Sohio's position as a net crude buyer, any facilities installed would have to serve for any crude processed in the future. In this light it was not considered too unrealistic to view all of the crudes from a common process lineup — differing only in the size required to make the same light products (furnace oil and lighter).

In determining the crude design range, most of the emphasis was placed on capacity and capital cost considerations. Although under existing pricing certain crudes might offer the opportunity to quickly pay out the additional capital requirements, this was not given a great deal of weight in arriving at a decision. It was felt that, in general, these opportunities would [illegible] ish over the years as refiners took [illegible]dvantage of them and the market p[illegible]ce of the crude would adjust itself. By the same token a choice of too narro[illegible] a design range might easily put Sohio in a poor competitive position. So, while true refining values of each of the crudes were not determined and the design type decision was based largely on capacity and capital considerations, the decision was not made without a knowledge of relative crude prices and operating costs.

Effect of Crude Type On Costs

Fig. 3 shows the increased capital cost over a base case (38 deg API crude) to permit running a range of crudes. The capacity in all cases is in the range of 55 to 65,000 bbl per stm day. Chart shows that to be able to run a 36 to 40 deg API range requires an investment of about $600,000 more than a refinery designed to run exclusively the 38 deg API crude. It further shows that basic corrosion protection for this range costs about $750,000 and an additional $3,500,000 is required in order to process a sour crude.

For our purposes basic corrosion protection was defined as protecting the major vessels and equipment so that the refinery could be converted to an alternate sour crude operation in a logical procedure without costly (and sometimes unsatisfactory) field changes or excessive downtime. Cost of a refinery designed to process sour crude is increased by the following additions to the basic refinery:

1. Desulfurization facilities.
2. Sulfur recovery facilities.
3. Replacement of lines, exchangers, etc., with alloy equipment to resist sour crude operation.

Fig. 4 further shows that to cover the range 33 to 40 deg API increases the capital cost about $7 million but the next step (to 30 deg API) can be included for only an additional $1 million. To include the next range (down to 26 deg API) then requires another $2 million investment.

These numbers represent total cost to be able to process any of the crudes indicated. They do not, however, necessarily reflect the initial capital cost requirements. For example, the major basic units must be designed to be able to process the total range chosen. However, some of the crudes require additional alkylation capacity (over that already available at Toledo) and this could be constructed at a later date when required or attractive. Also in the category of later possible additions, of course, are desulfurizing and sulfur recovery facilities if it is planned to initially process sweet crude. Fig. 4

shows the increase in initial investment required to be able to process a range of crudes as compared to the base (38 deg API). In these numbers only basic corrosion protection is supplied. This chart shows that it costs an additional $4 million to provide the facilities to process a range of 30 to 40 deg API rather than the 38 deg API base.

Effect of Crude Type on Capacity

The effect of crude type on operational capacity is shown in Fig. 5. The data on which this chart is based were calculated on the assumption that each of the light products produced at any point considered would be the same percentage of the total light product mix. As such the curves represent the worst case in terms of crude rate reduction. How realistic they would be in any given case would depend on the flexibility available in other processing facilities to shift the product demand and thus alter the ratios of light products. The figure shows the capacity of a refinery to make the same product mix when crudes outside of the design range are processed. For example, if the refinery were designed for a 38 deg API crude (requiring in this case 58,000 bbl per stm day of capacity), only 20,000 bbl per stm day of 31 deg API crude can be processed (limited largely by coking capacity). However, if the refinery were designed to process a 34 to 40 API range, then about 38,000 bbl per stm day of 31 deg API crude could be run in the same facilities. The top line of the chart labeled "Crude Rate" indicates the crude rate required to meet the same light product demand. Curve is discontinuous at about 34 deg API because additional alkylation and isomerization facilities are required for the heavier crudes.

Study of all of the data concerning design crude led to the following conclusions:

1. Except for heavy sour crude, all of the crudes considered available fell in the gravity range of 30 to 40 deg API.
2. Heavy sour crude was not a practical design crude for Sohio from the standpoint of the crude rate required and the product mix produced (excessive amounts of coke and heavy fuel).
3. A plant designed to process 31 to 40 deg API sweet crudes would initially cost about $3,000,000 more than one designed to process 38 deg API crude.
4. Basic corrosion protection would cost $800,000.

It was decided to design for 31 to 40 deg API sweet crude and include basic corrosion protection. This gave the advantage of lower initial capital cost without sacrificing the ability to later include the additions required to process a sour crude of 31 to 40 API range. Space has been left in the plot plan for possible future desulfurization, alkylation, isomerization, and sulfur recovery facilities.

Product Mix

The product mix to be made from the reduced crude at the new refinery was based on economic considerations. The light product mix (furnace oil and lighter) requirements had been determined as one of the first steps in the initial planning. However, whether we should produce heavy fuel, asphalt, fluid coke, delayed coke, or some combination remained to be determined.

At this point in the studies the location and the light product requirement had been established. Although the crude range had been established it was important to examine each type

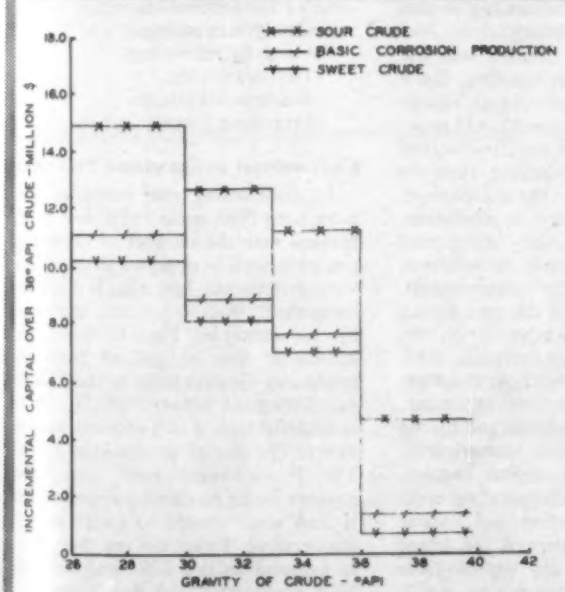

FIG. 3. Increase in capital cost over 38 deg API crude to permit running a range of crudes.

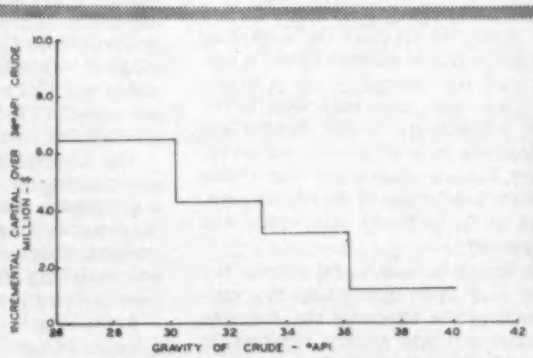

FIG. 4. Increase in capital cost over 38 deg API crude to permit running a range of crudes. Initial investment only, subject to later additions, with basic corrosion protection.

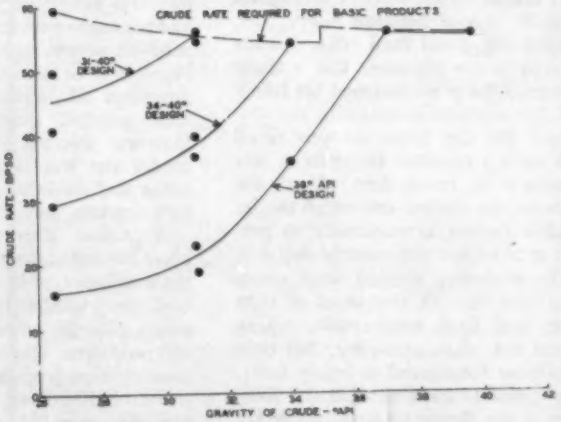

FIG. 5. Capacity when running crudes outside crude design basis range.

within the range from the product mix viewpoint. It would be undesirable to arrive at a product mix not consistent throughout the range unless there were some over-riding factors which would influence the choice. Accordingly, in the product mix studies light sweet, light sour, and heavy sour crudes were studied. As previously mentioned the studies were based on four possible product mixes:

1. Fluid coke,
2. Delayed coke,
3. Heavy fuel,
4. Heavy fuel and asphalt.

Additionally, catalytic cracking of gas oil plus residuum was considered as an alternate to the best of these in the case of light sweet crude to determine if there were any significant advantages to the process for Sohio. Heavy fuel and asphalt were combined into one case since the marketing department did not feel that there existed a substantial enough market to accommodate all of the asphalt made from the new refinery plus that already scheduled in our existing refineries.

Early in the game it became apparent that in no case would the product mix from a heavy sour crude dictate the choice. In all cases the marketing burden would be substantial but it was felt that the disposal problem would be easier with coke than with heavy fuel. Accordingly, it was decided not to continue these studies beyond the refinery balance studies and cast a plus vote in favor of one of the coking processes as far as heavy sour crude was concerned.

It would be nice to be able to say here that after calculating the economics of the alternates the desirable product mix was readily apparent. It would be nice — but such was not the case. In the cases of both light sweet and light sour crudes there was no clear choice on the basis of economics alone to choose between heavy fuel, delayed coke, and fluid coke. Results were so nearly the same that a slight change in the price assumed for heavy fuel, for example, could swing the economics 180 deg. Since we were faced with such a sensitive situation, it was necessary to re-examine all of the bases for the studies and weigh the intangible factors as accurately as possible in order to reach a sound decision.

The reasoning applied went something like this. In the cases of light sweet and light sour crude, coking looked the most attractive, but only slightly so (compared to heavy fuel). This indicated the desirability of flexibility in the design to allow for either coking or visbreaking for heavy fuel production.

Fluid coking, while almost equally as attractive as delayed coking and heavy fuel production, presented some serious disposal problems. It was felt that fluid coke would have to be marketed to a large (perhaps single) industrial consumer who would require that the coke be supplied on a full-time basis. Thus there would be no opportunity to take advantage of attractive heavy fuel prices as the market fluctuated.

It was therefore decided that for design purposes the product mix should be that resulting from a delayed coking operation. However, it was further decided that the coker should be designed with the flexibility to carry on either a delayed coking or a visbreaking operation. This would allow us to take advantage of attractive heavy fuel marketing situations as they developed.

Process Lineup

The product mix studies established one of the units in the process lineup — a delayed coker. However, they had not determined whether the feed to the coker should be atmospheric or vacuum reduced crude. Since there was no lube or asphalt requirement there was no reason from a product viewpoint to include a vacuum distillation unit in the lineup. Studies made at this time, however, indicated it to be advantageous to include a vacuum unit to obtain the maximum return not only per barrel of crude processed, but also per dollar of investment.

The economics of catalytic vs thermal cracking of gas oil have long been established as have the economics of catalytic vs thermal reforming of naphtha. Therefore, these units—catalytic cracking and reforming — also were included in the lineup.

Remaining to be decided was the question of light ends handling. Since we had alkylation facilities at Toledo which, with minor revamps, could process the butylenes, the only unresolved item was propylene handling. Here we had to choose between the alternates of catalytic polymerization or alkylation. For some of the crudes considered propylene alkylation was necessary to meet product quality requirements. However, this was not the case for all crudes but was dependent upon the ratios and qualities of reformer feed, light naphtha, and coker light distillate.

Alkylation of propylene, of course, upset the isobutane balance and forced the installation of butane isomerization facilities. Additional capital requirements plus the added operating costs for propylene alkylation and butane isomerization overbalanced the lower crude requirements and capital costs for the case of propylene polymerization.

It was, therefore, decided to polymerize the propylenes at the new refinery. In determining the crudes which will be run at the refinery in the future, propylene alkylation is a factor which will have to be considered. Although some of the crudes need such facilities to meet product quality requirements they are not *per se* excluded from consideration. Economics at the time may be such that Sohio can justify the installation of alkylation and isomerization facilities as required. Space has been left in the plot plan for future installation of these facilities.

Two further points should be made concerning process lineup:

1. While the studies reported considered only conventional processes, other processes were considered and discarded early in the game since the economics were so unfavorable to Sohio. Among these were hydrogenation of the vacuum bottoms or atmospheric reduced crude rather than delayed coking. This was particularly unattractive in cases involving sour crudes when all of the reformer hydrogen production was committed to desulfurization of the products.

2. The process lineup studies merely determined the type of unit to be built —not the process to be used. This was determined in other studies which determined the design direction. For example, planning studies indicated a catalytic cracking unit should be included — but other studies were required to determine what type of cracker should be used. These studies were carried out by our specialists in each of the fields.

The process lineup determined was:

Atmospheric topping,
Vacuum reduction,
Catalytic cracking,
Catalytic reforming,
Delayed coking,
Butylene alkylation,
Propylene polymerization.

Conventional vs Integrated Processing

In considering the refineries that have been built since 1950, one is impressed with the number of them that are integrated as opposed to those that are conventional. Just what is meant by integrated? Well — it's best explained by an example. Fig. 6 shows the schematic flow of gas oil from the crude and vacuum units to the TCC at our Cleveland refinery which can be considered typical of a conventional refinery. The gas oil produced at 500 to 550 F exchanges heat with other streams in the processing sequence and is then water cooled to a safe storage temperature. From storage the gas oil is pumped to the TCC unit through heat exchangers and finally enters a furnace at about 425 F. Thus, the heat equivalent to an average of about 100 F of temperature has been lost at this

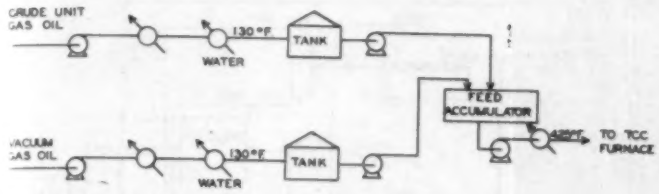

FIG. 6. Example of oil flow in a conventional refinery.

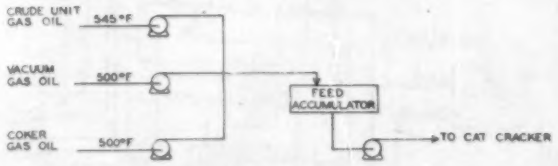

FIG. 7. Example of oil flow in an integrated refinery.

point. Additionally, there have been cooling water requirements.

Fig. 7 shows how the same situation could be handled in an integrated plant. Here the gas oils are fed directly to the cat cracker with little or no heat loss — and certainly none thrown away to water at added expense. This is just one example, but illustrates the concept of integration.

Table 1 shows the major domestic refining installations that have been built since 1950. Six of the nine installations cited are integrated and one other, Standard of Indiana at Mandan, is at least partially integrated. Why have so many refiners turned to integration? We feel that the answer lies in both capital and operating cost considerations.

Fig. 8 presents the picture regarding capital costs. On this chart are shown the capital cost per barrel per stream day as a function of capacity for both integrated and non-integrated refineries. This data was developed through literature references, Sohio's experience, contractors' experience, and from data appearing in "The Growth of Integrated Oil Companies."*

This chart shows that there are substantial capital savings possible for moderate to large-sized oil refineries if they are built with an integrated rather than a conventional design. Where do these savings arise and what is sacrificed — since the old adage is still true — "you don't get something for nothing." Table 2 gives the breakdown for a 60,000 bbl per stm day refinery. The big differences in costs occur in intermediate tankage and working capital categories, and account for about 75 percent of the difference. Thus, there are undoubtedly some sacrifices in operational flexibility. For example, to save the majority of the intermediate tankage capital it is necessary to shut the entire plant down at once rather than a unit at a time.

Fig. 9 presents the story regarding operating costs. Here the operating costs in dollars per barrel of crude processed are plotted as a function of refinery size for both integrated and non-integrated refineries. This information was developed from the same sources mentioned in the discussion of capital costs. Again the picture is in favor of integrated plants. In all cases considered the integrated refiner is able to operate at a lower cost than the conventional refiner.

To summarize, we feel that an integrated refinery offers the following advantages:

1. Lower capital cost,
2. Lower operating cost,
3. No appreciable loss in flexibility.

Refinery Capacity

In general there are three considerations that dictate the size of a new refinery. These are:

1. Period to be covered (product demand).
2. Capital cost and lower per barrel cost of small increments in size.
3. Operating ease.

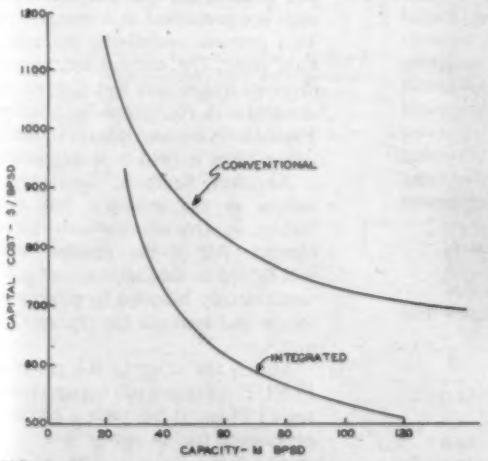

FIG. 8. Capital cost per bbl conventional vs integrated refineries.

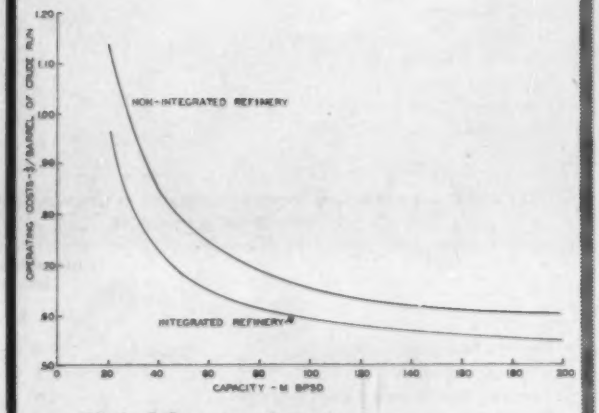

FIG. 9. Refinery operating costs.

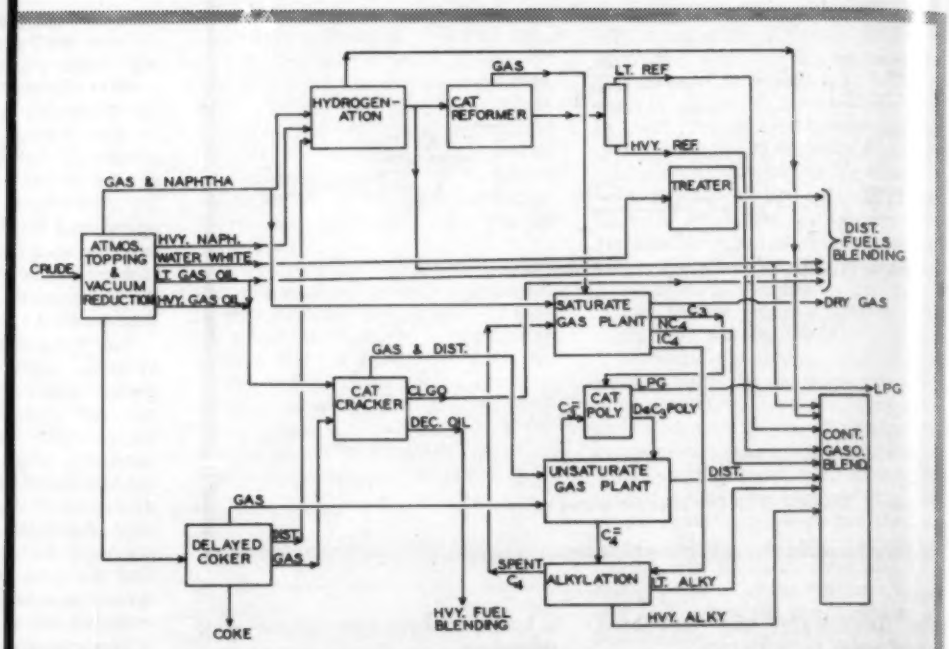

FIG. 10. Process flow.

Naturally a great deal of judgment is exercised in reaching a final decision since no mortal can develop numbers which will completely answer all three of these areas. In general the larger a unit is built the cheaper the per barrel cost of the unit. This is just another way of saying that marginal capacity is cheaper than the basic unit. Operationally, a peak is reached beyond which maintaining good steady operation is more of a task. This area is one in which judgment and experience take a seat down in front. Surely refiners have built and operated units which are larger than those we plan. However, our people with operating experience feel pretty firmly that as far as Sohio is concerned we don't want to burden ourselves with the problem of operating units much larger than those we plan now. Considering all of the factors, Sohio decided to build a 60,000 bbl per stm day new, integrated refinery at Toledo, Ohio.

TABLE 1. Typical New Refineries Since 1950.

Tidewater, Delaware City	Conventional
Amoco, Yorktown	Conventional
Shell, Anacortes	Part Integrated
Standard of Indiana, Mandan	Integrated
Socony, Ferndale	Integrated
Petrofina, Montreal	Integrated
International, Wrenshall	Integrated
Great Northern, Pine Bend	Integrated
Sun, Sarnia	Integrated

TABLE 2. Capital Cost Increase Integrated vs Conventional Refinery. (60,000 bbl per std day)

	Conventional Higher than Integrated by	
	MM $	%
Process facilities	3.0	11.0
Utilities and wastes	0.3	5.5
Tankage and transfer lines	4.6	49.0
Working capital	4.3	48.0
Total	12.2	23.0

And what will this refinery look like? Fig. 10 shows the process flow. The lineup of the sections is not uncommon in the industry. However, some of the operations we believe are unique.

Hydrogenation is used to treat both the light naphtha for gasoline blending and the heavy naphtha for reforming. It was found to be more economical to build one large unit to treat the streams simultaneously than to build separate units for each stream.

The gas recovery and synthesis sections are perhaps the best illustration of a unique design. In these sections the saturated light ends are handled in one plant while the unsaturated light ends are processed in a separate plant. This permits optimizing the usage of light ends. The normal butane can be diverted to gasoline blending while the isobutane is recovered for alkylation. Thus, the N-butane diluent in the alkylation plant is held to a minimum.

Another feature, certainly not unique in the industry, but new to Sohio, is the continuous gasoline blender. All of the gasoline streams will be fed to this section and gasoline continuously blended to pipeline shipments and tankage for transport shipments.

This is the story of the planning of PINUP (Proposed Integrated NU (new) Plant. It has been a challenging experience for all concerned.

*"The Growth of Integrated Oil Companies," McLean, John G., and Haigh, Robert W., Graduate School of Business Administration, Harvard University, 1954. ★ ★ ★

AT Sohio's Toledo, Ohio refinery the compact 200 hp Cooper-Bessemer EM compressor shown here supplies shop air at an exceptional saving: a saving in space, in maintenance costs and over all operating expense.

Offering such important design advancements, such as natural force balance, these M-Line units deliver smooth performance without vibration.
This installation is typical of the many important jobs being handled with dependable equipment furnished by Cooper-Bessemer.

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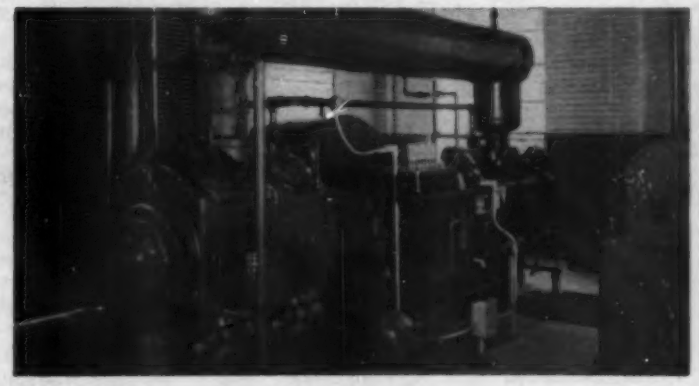


This two-cylinder Cooper-Bessemer air compressor, *with 5-step unloading, efficiently handles shop air requirements at Sohio's Toledo Refinery. Note the neat and compact appearance.*

Cooper/Bessemer

GENERAL OFFICES: MOUNT VERNON, OHIO

ENGINES: GAS - DIESEL - GAS-DIESEL
COMPRESSORS: RECIPROCATING AND CENTRIFUGAL
ENGINE OR MOTOR DRIVEN

SURVEY OF CONSTRUCTION activities of domestic and foreign refiners shows conclusively that foreign refining capacity will significantly outstrip U. S. capacity in the near future. Just about a year ago, foreign capacity for the first time drew abreast that of this country.

Total new foreign crude oil capacity planned or under construction is now about 1,550,000 bbl per day, compared to 720,000 bbl per day in the U. S. These figures are derived from the summary table below and are the totals of "New Refineries" and "Crude Distillation."* The latter column represents primary crude distillation capacity under construction in *existing* refineries, thus eliminating the possibility of double counting.

The summary table also evidences the continuing, albeit decreasing, rate of catalytic reforming capacity increase in this country. It now appears that the ultimate catalytic reforming capacity will reach about 25 to 30 percent on crude capacity. On the other hand, octane rating is taking on increasing importance outside the U. S., with construction of catalytic reforming units still increasing.

A total of 23 natural gasoline plants are reportedly planned or under construction in this country. Total capacity for 146,000 MMcf per day was reported for 14 of the plants, while capacities for nine of the projects were not reported. Largest of the plants will be rated at 750 MMcf per day; it is being built by Humble Oil and Refining Company on the King Ranch north of Corpus Christi, Texas.

Well over 100 new petrochemicals plants are in planning or construction stages in this country, while the marked trend for petrochemicals expansion in other countries continues strong. A total of 64 new petrochemicals plants have been announced for foreign countries.

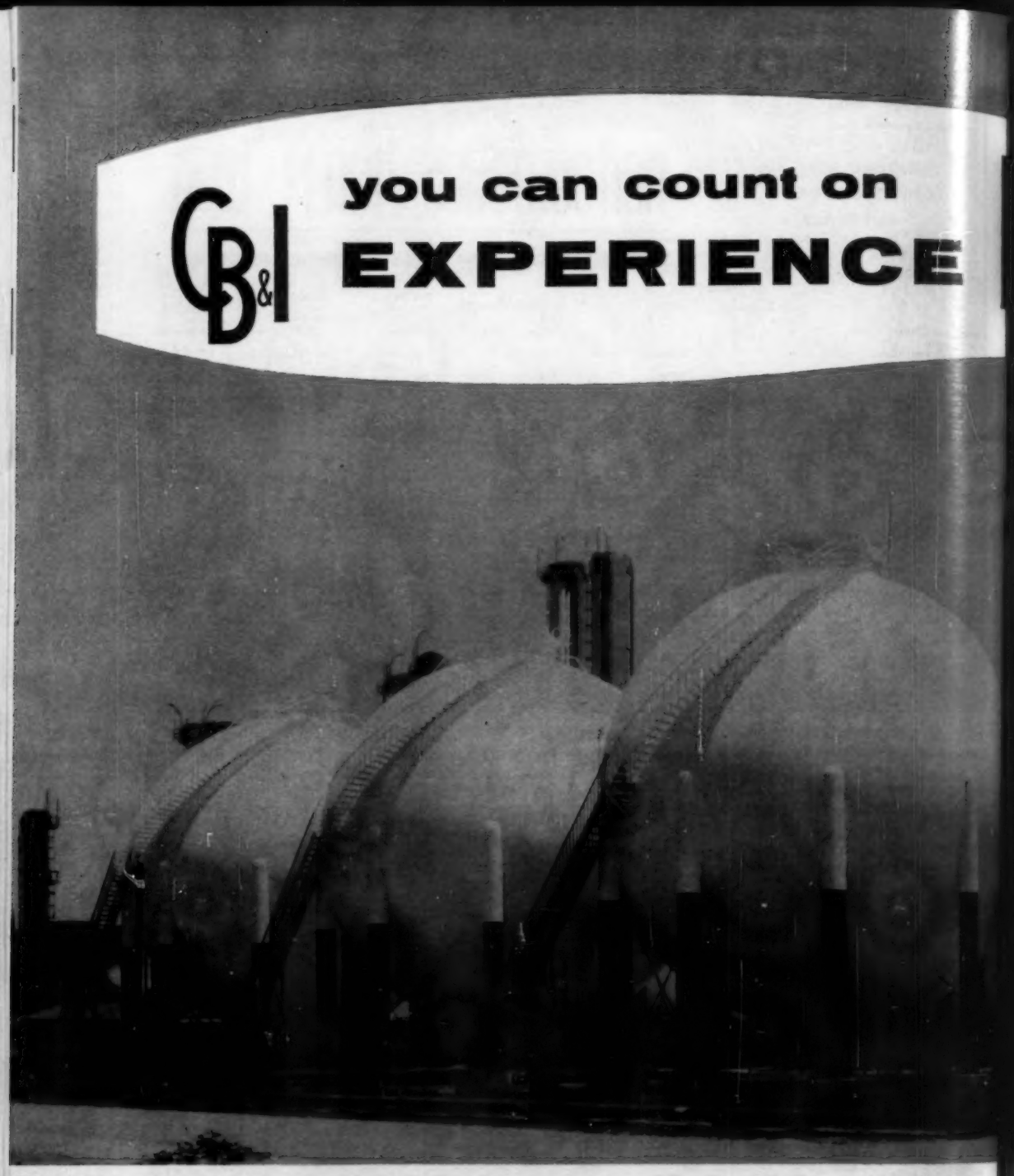
*Total capacities are prorated from reported capacity.

Summary of World-Wide Refinery Construction

	United States			Foreign		
	Total planned or under construction	Projects reporting capacity	Total reported capacity (bbl per day)	Total planned or under construction	Projects reporting capacity	Total reported capacity (bbl per day)
New refineries[1]	14	13	335,000	34	30	1,052,850
Crude distillation	11	10	331,500	10	10	297,000
Catalytic cracking	18	16	197,100	14	12	70,220
Catalytic reforming	44	39	328,530	34	31	260,610
Hydrodesulfurization	21	20	163,180	34	29	304,300
Alkylation	19	17	41,150	9	6	10,150
Isomerization	7	6	32,500	—	—	—
Coking	2	2	29,000	2	2	1,500
Asphalt	6	3	27,300	—	—	—

[1]Specific process units for new refineries are not included in data reported under other titles below.

Owner-Operating Company	Construction Company	Engineering and Design Company	Location	Type of Plant or Unit	Rated Capacity	Cost	Scheduled for Completion
Allied Chem. & Dye Corp.	Staff & Semet-Solvay Div.	—	Buffalo, N. Y	Polyeth	—	—	Mid 1958
American Cyanamid, Inc.	—	—	Frontier, La.	Acrylonitrile	—	$25,000,000	1958
	—	—	Santa Rosa, Fla.	Acrylics	25 MM lb/yr	—	—
American Oil Co.	Tellepsen Petro-Chem. Constr.	—	Texas City, Tex.	Gaso Frac (Revamps)	—	—	Jan. 1958
	"	—	Texas City, Tex.	Heating Oil System	—	—	1958
	"	—	"	Ultraform Feed Prep	—	—	1958
	"	—	"	Two-Stage Crude Dist	—	—	1958
	Ralph M. Parsons Co.	Standard (Ind.)	"	Desulf-Ultraform	21,000 BPD	—	Feb. 1958
American Petrofina Inc.	—	—	Yorktown, Va.	Asphalt Prod	25,000 BPD	—	1958
	—	UOP	Mt. Pleasant, Tex.	Platform	3000 BPD	$1,000,000	Jan. 1959
	—	—	"	Alkylation	1500 BPD	$1,500,000	Feb. 1959
	—	—	"	Ref Expan	15,000 BPD	—	—
	Tears Engineers	UOP	Wichita Falls, Tex.	Platform	3000 BPD	$625,000	Early 1958
	—	—	"	Expansion	10,000 BPD	—	—
Ammonia Chem. Corp. of Fresno	—	—	Fresno, Calif.	Ammonia	100 T/D	$5,000,000	—
Amoco Chem. Co.	—	Scientific Design Co.	Joliet, Ill.	Phthalic Anhydride, etc	60 MM lb/yr	$10,000,000	1958
Anderson Prichard Oil Corp.	Ref. Eng. Co.	UOP	Arkansas City, Kans.	Alkylation	2400 BPD	—	Late 1958
Arkansas Fuel Oil Corp.	Delta Engrg. Corp.	—	Greggton, Tex.	Nat Gaso	25 MMCFD(inc)	$350,000	Apr. 1958
Ark. La. Gas Co.	Staff	—	Waskom, Tex.	Nat Gaso	25 MMCFD(inc)	$150,000	Jan. 1958
Ashland Oil & Ref. Co.	—	UOP	Buffalo, N. Y.	Aromat (BTX)	20 MM gal/yr	—	Jan. 1958
Atlantic Ref. Co.	Badger Mfg. Co.	Texaco Lic.	Phila., Pa.	MEK Dewax-Deoil	—	—	Early 1959
	Fluor Corp.	—	Port Arthur, Tex.	HF Alky	2100 BPD	—	Mid 1958
Atlas Powder Co.	Chem. & Ind. Corp.	Same	Atlas, Mo.	Expansion	—	$4,000,000	—
Atlas Proc. Co.	Hudson Engrg. Corp.	UOP	Shreveport, La.	Hydroisom	3500 BPD	—	Mar. 1958
Balfour-Guthrie & Co.	—	—	Tacoma, Wash.	Syn Resins	50,000 BPD	—	—
Bankline Oil Co.	Staff	Staff	Bakersfield, Cal.	Alky (Revamp)	800 BPD	$500,000	—
Bay Petr. Corp.	M. W. Kellogg Co.	Sinclair-Baker	Denver, Colo.	Cat Reform	3800 BPD	—	Mar. 1958
Bay Refining Corp.	Southwestern Engrg. Co.	—	Bay City, Mich.	Crude	12,000 BPD	—	1959
Ben Franklin Ref. Co.	Ref. Engrg. Co.	UOP	Ardmore, Okla.	Alkylation	1000 BPD	$1,000,000	Early 1958
Brazos River Gas Co.	Purvin & Gertz Inc.	—	Mineral Wells, Tex.	Expansion	Increase to 25 MMCFD	$122,000	Late 1958
Calcasieu Chem. Corp.	Lummus Co.	Shell Dev. Co.	Lake Charles, La.	Eth Glycol	8 MM gal/yr	$10,500,000	Mid 1958
Cal. Ammonia Co.	—	—	Lathrop, Cal.	Ammonia	100 T/D	$4,800,000	Oct. 1958
Cal. Oil Co.	Staff	Houdry Proc. Corp.	Perth Amboy, N. J.	Cat Cracker Expansion	2000 BPD	—	May 1958
	H. K. Ferguson Co.	UOP	"	Two-Stage Platform	10,000 BPD	—	Late 1958
Callery Chem. Co.	Blaw-Knox Co.	Same	Lawrence, Kans.	Boron Chem	—	$3-4,000,000	Early 1958
		Girdler Co.	Muskogee, Okla.	Hydrogen	—	—	Fall 1958
				Nitrogen			
	Ralph M. Parsons Co.	Same & Callery Chem. Co.	"	CO2 Rocket Fuel	—	$38,000,000	—
	Foster Wheeler Corp.	Same		Ethylene	—	—	—
Cal-Mex Oil & Ref. Co.	Ralph M. Parsons Co.	Same	San Diego, Cal.	Refinery	20,000 BPD	$27,000,000	Early 1959
Caminol Co.	Litwin Engrg. Co.	UOP	Hanford, Cal.	Platform	1300 BPD	$500,000	Apr. 1958
Carbide & Carbon Chem. Co.	—	—	Institute, W. Va.	Acrylonitrile Expansion	Double Cap	—	1958
Champlin Oil & Ref. Co.	Badger Mfg. Co.	—	Enid, Okla.	HF Alky	1500 BPD	$1,500,000	Apr. 1958
Chemoil Corp.	Lummus Co.	—	Baton Rouge, La.	Ref & Petrochem	40,000 BPD	$40,000,000	Nov. 1959
Chemstrand Corp.	—	—	Decatur, Ala.	Acrylan Expan	45 MM lb/yr	—	Early 1958
	Staff	—	Pensacola, Fla.	Nylon Expan	110 MM lb/yr	—	Mid 1958
Cit-Con Oil Corp.	Tears Engrs., Hydrocarbon Const. Co.	—	Lake Charles, La.	Lube Oil Expan	10,000 BPD	$4,000,000	Mar. 1958
	—	—	E. Chicago, Ind.	Cat Reform	—	—	—
	—	—	Laverne, Okla.	Nat Gaso	100 MMCFD	—	—
Cities Service Oil Co. (Pa.)	—	—	Linden, N. J.	Expan Asphalt	—	—	—
	Tellepsen Petro-Chem. Constr.	—	Lake Charles, La.	Cat Reform	—	—	1958
	"	—	"	Butane Isom	—	—	1958
Clark Oil & Ref. Co.	Procon, Inc.	Same	Blue Island, Ill.	Cat Cracker	12,500 BPD	$7,250,000	Early 1958
	—	—	Chicago, Ill.	Vac Dist	—	—	—
	Procon, Inc.	UOP	Chicago, Ill.	Cat Cracker Gas Recov	—	—	Spring 1958
Colo. Interstate Gas Co.	—	—	Fourway, Tex.	Nat Gaso	65 MMCFD	—	Dec. 1958
Columbia Gas System	J. F. Pritchard & Co.	—	Kenova, W. Va.	HC Recov	—	$8,000,000	—
	"	—	Siloam, Ky.	Frac	—	$5,000,000	—
Commerce Oil Ref. Corp.	Fluor Corp.	—	Jamestown, R.I.	Refinery	43,000 BPD	$50,000,000	June 1959
Commercial Solv. Corp. & Columbia Gas System Inc.	—	Commercial Solv.	Ohio Valley	Eth Deriv	—	$40-50,000,000	1958
Consumers Coop. Ref. Assoc.	Refinery Engrg.	—	Coffeyville, Kans.	HF Alky	1100 BPD	$1,500,000	Mid 1958
	Southwestern Engrg. Co.	Process Design, UOP	Phillipsburg, Kans.	Platform-Unifin	3500 BPD 2500 BPD	$1,250,000	Early 1958
Continental Carbon Co.	—	—	Sunray, Tex.	Oil Black (conv)	—	$375,000	Early 1958
Continental Oil Co.	Fluor Corp., Ltd.	Same	Lake Charles, La.	Coker Calcining	10,000 BPD	$6,300,000	Jan. 1958
	Refinery Engrg. Co.	—	Wichita Falls, Tex.	Cat Reform	3500 BPD	$1,500,000	Early 1958
Copolymer Rubber & Chem. Corp.	Staff	—	Baton Rouge, La.	Research Lab	—	$350,000	June 1958
	"	—		Power	9000 KW	$3,000,000	Oct. 1958
Cosden Petr. Corp.	Badger Mfg. Co.	Same	Big Spring, Tex.	Unifin	2100 BPD	—	—
Davison Chem. Co.			Casper, Wyo.	Sulf Acid	200 T/D	$2,000,000	July 1958
	—	Phillips Petr. Co.	Cincinnati, O.	Polyole Cat	8000 lb/D	—	—
Delta Ref. Co.	—		Memphis, Tenn.	Platform	2000 BPD	—	—
	J. F. Pritchard & Co.	Litwin Engrg.	Wichita, Kans.	Crude Expan	—	—	—
	—	—	"	Alky Expan	1000-1500 BPD	—	—
Diamond Alkali Co.	—	—	Houston, Tex.	Acetylene (Proposed)	—	—	—
	Scientific Design & Brown & Root	—	"	Vinyl Chlor Mon	—	—	1958
	Lummus Co.	—	"	Trichloroeth	—	—	1959
	Litwin Engrg.	Socony Mobil	Wichita, Kans.	Cat Crack (TCC)	9000 BPD	$500,000	May 1958
Dow Chem. Co.	Austin Co.	Girdler Co.	Bay City, Mich.	Eth Gas	—	—	Jan. 1958
	—	—	Freeport, Tex.	Acrylonitrile	—	$45,000,000	Early 1959
	—	—	Plaquemines, La.	Chemicals	—	$50,000,000	Spring 1958



The increasingly complex operations at modern refineries and petrochemical plants calls for the most exacting attention to the important details of design, fabrication and erection of refinery towers, tanks, and allied steel plate structures that can mean success or failure in today's petroleum processing operations.

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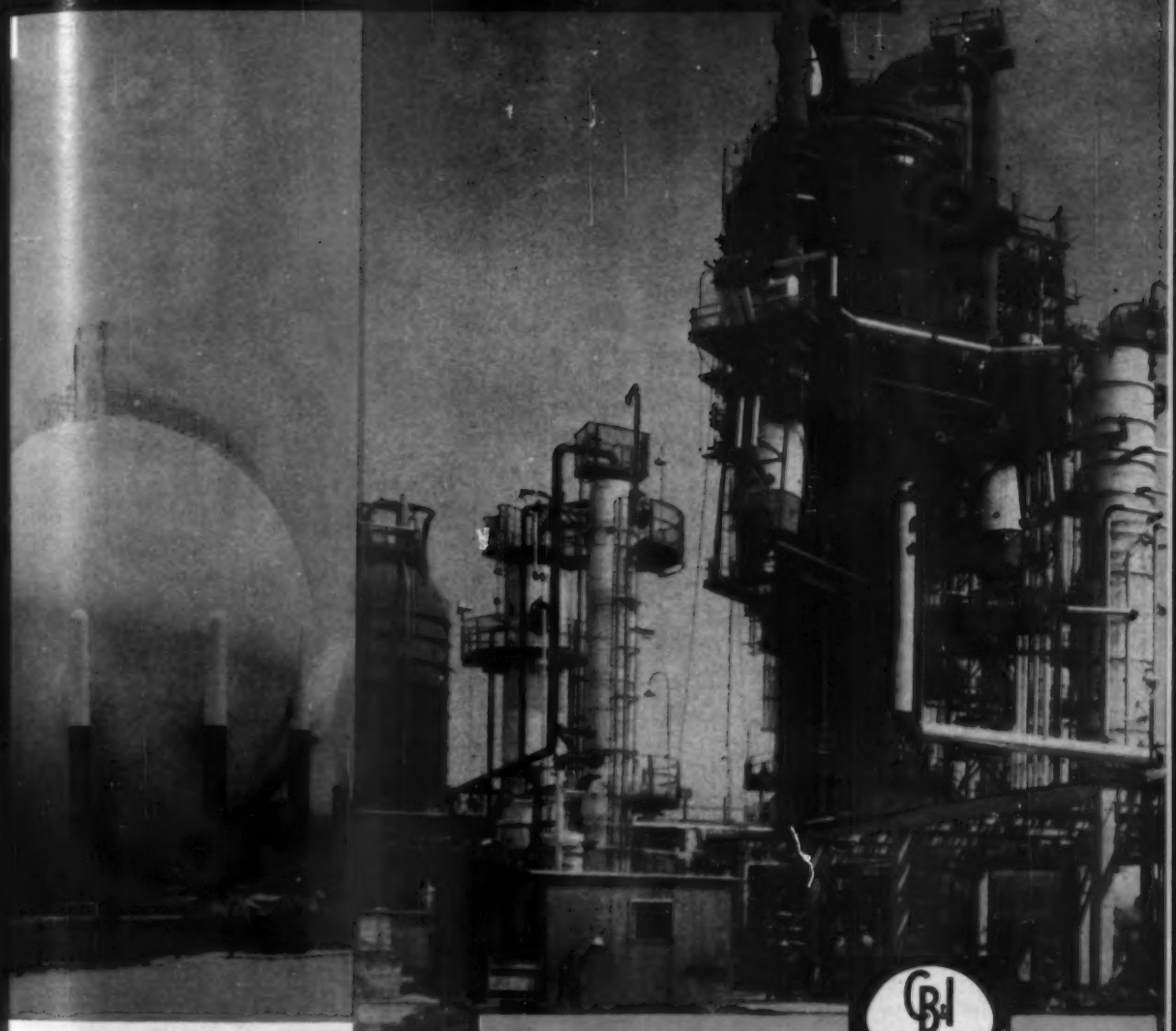

P65SCB

ABOVE, LEFT: 19 Hortonspheres® are included in the extensive storage facilities furnished by CB&I through The Fluor Corp., Ltd., for the multi-million dollar plant of *Texas Butadiene and Chemical Corporation*, near Houston, Texas.

ABOVE, RIGHT: Components for this Orthoflow Converter, for the new *American Oil Company* refinery at Yorktown, Virginia were fabricated by CB&I and furnished through the M. W. Kellogg Company. CB&I-built components included a reactor, regenerator, vacuum tower, crude tower, absorber tower and catalyst hoppers.

CB&I

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Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, GREENVILLE, PA. and NEW CASTLE, DEL.

REPRESENTATIVES AND LICENSEES:
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SUBSIDIARIES:
Horton Steel Works Limited, Toronto; Chicago Bridge & Iron Company Ltd., Caracas; Chicago Bridge Limited, London; Sociedade Chibridge de Construcoes Ltda., Rio de Janeiro.

Owner-Operating Company	Construction Company	Engineering and Design Company	Location	Type of Plant or Unit	Rated Capacity	Cost	Schedule for Completion
E. I. du Pont de Nemours & Co.	—	—	Belle, W. Va.	Ammonia & Deriv Exp	—	—	Early 1959
	—	—	—	Polyeth & Polyform Plastic Expan.	—	—	—
D-X Sunray Oil Co.	Ref. Engrg. Co.	UOP	Tulsa, Okla.	Butane Isom	2500 BPD	—	Mar. 1958
El Paso Nat. Gas Co.	Stearns-Roger Mfg. Co.	—	Farmington, N. M.	Nat Gaso	165 MMCFD	—	Jan. 1958
	Delta Engrg. Co.	—	Crane Co., Tex.	Modern	—	—	"
	"	—	"	Purif Modern	—	—	"
El Paso Nat. Gas Prod. Co.	Fish Engrg. Corp.	UOP	Odessa, Tex.	Refinery	9000 BPD	$11,000,000	Apr. 1958
Escambia Chem. Corp.	Chem. Const. Corp.	—	Pensacola, Fla.	Methanol	393,000 BP/yr	—	Early 1958
	—	—	Wilton, Conn.	Res Center	—	—	Early 1958
Esso Standard Oil Co.	Midvalley Const. Co.	—	Baton Rouge, La.	LPG Underground Stor	1,000,000 BPD	—	Feb. 1958
	Fenix & Scisson	Same & Esso Res. & Engrg. Co.	Bayway, N. J.	"	600,000 BPD	—	Sept. 1958
	—	Esso Res & Engrg. Co.	Linden, N. J.	Debutanix	20,000 BPD	—	Aug. 1958
	—	"	"	Light Oil Hydrofin	15,000 BPD	—	Aug. 1958
	—	"	Baton Rouge, La.	Solv Hydrofin	3600 BPD	—	1958
Ethyl Corp.	C. F. Braun & Co.	—	Pittsburg, Cal.	Antiknock Com	—	—	Mid 1958
Farmer's Union Cent. Exch.	Refinery Engrg. Co.	UOP	Laurel, Mont.	Unifin-	4400 BPD	$3,000,000	Apr. 1958
				Platform	5100 BPD	—	—
				Dist Unifin	7100 BPD		
Firestone Tire & Rubber Co.	Catalytic Constr. Co.	Houdry Proc. Corp.	Orange, Tex.	Styrene	70,000 T/yr	—	Early 1958
	—	—	"	Buta Expan	—	—	—
Fletcher Oil Co.	Ralph M. Parsons Co.	UOP	Wilmington, Cal.	Unifin-Platform	—	—	Early 1958
Food Mach. & Chem. Corp.	Fluor Corp., Ltd.	Same & Food Mach. Chem. Engrs.	S. Charleston, W. Va.	Carb Tetrachlor	Double Capacity	—	Early 1958
Foster Grant Co., Inc.	—	—	Leominster, Mass. & Manchester, N. H.	Styrene & Nylon Expan	—	$5,400,000	—
	—	—	Baton Rouge, La.	Styrene Expan	40 MM lb/yr	—	Nov. 1958
Frontier Ref. Co.	Procon, Inc.	UOP	Buffalo, N. Y.	Aromat Recov	45,000 gal/D	$3,750,000	Early 1958
Gen. Aniline & Film Corp.	Scientific Design Co., Inc.	Same	Linden, N. J.	Eth Oxide-Eth Glycol	60 MM lb/yr 35 MM lb/yr	$8,000,000	Early 1958
General Petr. Corp.	—	—	Ferndale, Wash.	Expansion	13,000 BPD	$7,000,000	1958
B. F. Goodrich Chem. Co.	Blaw-Knox Co.	—	Henry, Ill.	Antiox Chem	—	$5,000,000	Early 1958
Goodyear Tire & Rubber Co.	—	—	Houston, Tex.	Two Reactor Lines (11 Reactors each)	5000 gal/D	$10,000,000	—
	—	—	"	Buta Blend Tks	210,000 gal/D	—	—
	—	—	"	Plioflex Rubber Expan	220,000 LT/yr	—	—
Gulf Oil Corp.	Procon, Inc.	UOP	Phila., Pa.	Cat Reform #2	26,000 BPD	—	Early 1958
		Same, UOP & Gulf Oil Corp.	Port Arthur, Tex.	Pentane Isom	10,000 BPD	—	Late 1958
	Sumner Sollitt Co.	—	Port Arthur, Tex.	Greasemkg & Pkg Fac	—	—	Early 1958
	Procon, Inc.	Same & UOP	"	Platform	12,000 BPD	—	Early 1959
		Same		Benzene Recov	30 MM gal/yr	—	Late 1958
Gulf Ref. Co.	Procon, Inc.	Same & UOP	Port Arthur, Tex.	Platform	26,000 BPD	—	Early 1958
Hancock Oil Co.	Ralph M. Parsons Co.	Same	Signal Hill, Cal.	Cat Crack	2100 BPD	—	—
	"	"	"	Crude Cap	7000 BPD	—	—
				Visbreaking	3450 BPD	—	—
Hess Trading & Transport Inc.	—	—	Port Reading, N. J.	Refinery	—	$8,000,000	—
Humble Oil & Ref. Co.	Foster Wheeler Corp.	Same & Humble Ref. Co.	Baytown, Tex.	Cat Crack	55,000 BPD	$27,000,000	—
	Staff & O. L. Olsen Co.	"	Flour Bluff, Tex.	Nat Gaso Expan	—	$400,000	Early 1958
	Badger Mfg. Co.	Same & UOP	Baytown, Texas.	Benzene Recov	24 MM gal/yr	—	"
	Staff	—	"	Butyl Expan	13,000 LT/yr	—	Apr. 1958
	Hudson Engrg. Co.	—	"	Varsol Hydrofin	6000 BPD	—	May 1958
	M. W. Kellogg Co.	—	"	Eth, Lt Ends Recov	80,000 lb/yr	—	July 1958
	—	—	Corpus Christi, Tex.	Gas Proc & Cycling	750 MMCFD	$75,000,000	1958
	M. W. Kellogg Co.	Girdler Co.	Baytown, Tex.	Diethanol Gas Pur	2770 MCFD	—	—
Husky Oil Co.	—	—	Cody, Wyo.	Steam Plt Exp	30,000 lb/hr	$70,000	July 1958
Kerr-McGee Oil Ind., Inc.	—	Litwin Engrg. Co.	Cushing, Okla.	Crude Unit (Revamp)	30,000 BPD	—	—
	Refinery Engrg. Co. & C. W. Nofsinger Co.	UOP	Wynnewood, Okla.	Gaso Unifin	5500 BPD	—	July 1958
	"	"	"	Unifin	4000 BPD	—	July 1958
	"	"	"	Platform	5500 BPD	$4,000,000	July 1958
	Litwin Engrg.	UOP	Cleveland, Okla.	Platform Mod	2200 BPD	$300,000	Early 1958
	"	—	"	Naphtha Frac	—	$300,000	"
Koppers Co.	Staff	Same	Kobuta, Pa.	Polystyrene	—	—	Early 1958
La Gloria Oil & Gas Co.	—	UOP	Tyler, Tex.	Revamp FCCU & Gas Recov Sec.	3000 BPD	$2,000,000	Aug. 1958
	Brown & Root	—	"	SR Naphtha Stab	2000 BPD	$100,000	Feb. 1958
Leonard Refineries, Inc.	Ralph M. Parsons Co.	UOP	Alma, Mich.	Cat Crack	7500 BPD	$3,000,000	Aug. 1958
	"	"	"	HF Alky	1000 BPD	$1,100,000	Sept. 1958
Lion Oil Co., Div. Monsanto Chem. Co.	—	—	El Dorado, Ark.	Cat Reform Hydrodesulf	5000 BPD	—	Late 1958
				Stm Boiler	100,000 lb/hr	—	Late 1958
Lone Star Gas Co.	Staff	—	Garvin Co., Okla.	Nat Gaso Exp	40 MMCFD	$200,000	Mar. 1958
	"	—	Palo Pinto Co., Tex.	"	45 MMCFD	$1,000,000	"
	Graff Engrg. Corp. & Gasoline Plt. Const. Co.	—	Atascosa Co., Tex.	Gas Sweet & & Dehyd	100 MMCFD	$2,000,000	July 1958
Magnolia Petr. Corp.	Fluor Corp.	—	Beaumont, Tex.	LPG Frac Exp	—	—	Mid 1958
	Foster Wheeler Corp.	Same & Socony Mobil	"	Sovafin	30,000 BPD	—	"
	C. F. Braun & Co.	Same & Magnolia Petr. Co.	"	Sulf Alky	8000 BPD	—	Early 1958
	Foster Wheeler Corp.	Same	"	H2S Recov Unit	80 LT/D	—	"
	"	"	"	Crude Dist	100,000 BPD	—	Mid 1958
Midland Coop., Inc.	Sumner Sollitt Co.	Same	Fridley, Minn.	Lube Oil Blend	—	$600,000	Feb. 1958
Mississippi Chem. Corp.	Staff	—	Yazoo City, Miss.	Anhyd Ammon	30 T/D	$500,000	July 1958

Look both ways at Heat Transfer

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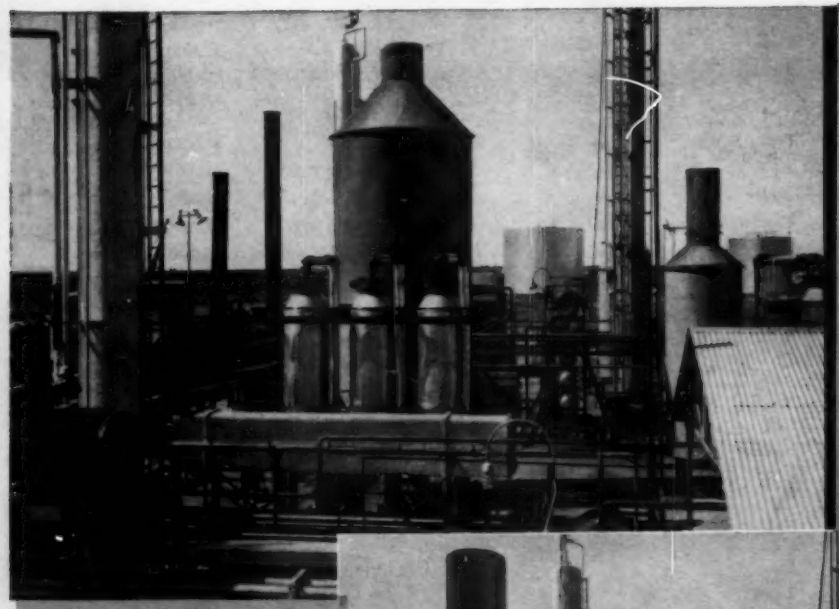
Owner-Operating Company	Construction Company	Engineering and Design Company	Location	Type of Plant or Unit	Rated Capacity	Cost	Schedule for Completion
Monsanto Chem. Co.	—	—	El Dorado, Ark.	Urea	100 T/D	—	Fall 19
	—	—	Texas City, Tex.	Acetylene Exp	12 MM lb/yr	—	Early 1
	—	—	"	Styrene Mon Expan	40 MM lb/yr	—	Mid 19
National Petro-Chem. Corp.	M. W. Kellogg Co.	—	Houston, Tex.	Polyeth	75 MM lb/yr	$20,000,000	Late 19
Naugatuck Chem. Div., U. S. Rubber Co.	Walter Kidde Constr., Inc., La. Indust. Serv.	—	Baton Rouge, La.	Plastics	—	$7,000,000	Jan. 19
Northern Chem. Ind., Inc.	Girdler Co.	The Texas Co.	Searsport, Me.	Anhyd Ammon	125 T/D	$9,000,000	Early 1958
Northwestern Ref. Co.	—	—	St. Paul Park, Minn.	Cat Reform	5000 BPD	$2,500,000	Early 1959
Odessa Styrene Co.	Fish Engrg. Corp.	UOP	Odessa, Tex.	Styrene	20,000 T/yr	$6,000,000	Jan. 19
Oil & Chem. Prod. Co.	—	UOP	Houston, Tex.	Platform, Udex, Penex	5000 BPD	$5,000,000	(Planning)
	—	—	"	Resin Poly (BTX)	2000 BPD	$150,000	Early 1958
Olin Mathieson Ind.	P. S. Edwards	—	Mapleton, Ill.	Glycol Eth	—	$1,500,000	Spring 1958
Pan American Petr. Corp.	Tuloma Builders, Inc.	—	Cottonwood Creek Field, Wyo.	Sulf Recov	20 T/D	—	Mar. 1958
	"	—	"	Gas Compr	10,000 gal/D	—	"
Pana Ref. Co.	—	UOP	Pana, Ill.	Platform	1500 BPD	$1,000,000	Summer 1958
Paragon Oil Co.	—	—	Rhode Island	Refinery	30,000 BPD	$35,000,000	1959
Permian Basin PL Co.	Dresser Engrg. Co.	—	Mitchell, Tex.	Carb Dioxide Remov	145 MMCFD	$3,000,000	Early 1958
Petrochem., Inc.	Foster Wheeler Corp.	Casale	Lake Charles, La.	Ammonia	100,000 T/yr	$12,000,000	Early 1958
	Lummus Co.	—	"	Ethylene	200 MM lb/yr	$20,000,000	"
Petr. Chem., Inc.	Foster Wheeler Corp.	—	Lake Charles, La.	Butyl Rubber	30,000 T/yr	$17,000,000	Late 1958
	Lummus Co.	Same		Ethylene	200 MM lb/yr	—	Jan. 1958
Petr. Spec., Inc.	Litwin Engrg.	—	Flat Rock, Mich.	Visbreak	3000 BPD	$250,000	Mid 1958
Phillips Chem. Co.	Tellepsen Petro-Chem. Const., Phillips	—	Phillips, Tex.	Copoly Expan	138 LT/D	—	Early 1958
Phillips Petr. Co.	Fluor Corp.	Phillips Petr. Co.	Sweeny, Tex.	Cat Reform	16,000 BPD	—	Jan. 1958
	Staff	UOP	Borger, Tex.	Pentane Isom	13,500 BPD	—	Early 1958
	Procon, Inc.	Same & UOP	Woods Cross, Utah	Cat Reform	3700 BPD	—	Spring 1958
	Staff	—	Kansas City, Kans.	Asphalt Expan	1100 BPD	—	Spring 1958
	Staff	—	Okmulgee, Okla.	Asphalt	1200 BPD	—	"
	Staff	—	Great Falls, Mont.	Asphalt Expan	—	—	"
	Staff	—	Sweeny, Tex.	Isom	1000 BPD	—	1959
	"	—	"	Alky Expan	2000 BPD	—	—
Platte Chem. Co.	Leonard Constr. Co.	—	Casper, Wyo.	Sulf Acid	200 T/D	$2,000,000	July 1958
Pontiac Ref. Corp.	Fluor Corp.	—	Corpus Christi, Tex.	Crude Unit	10,000 BPD	$850,000	May 1958
	"	UOP	"	Unifin	6000 BPD	$650,000	"
Processors, Inc.	—	—	Houston, Tex.	Resin Poly (BTY)	2000 BPD	$150,000	Early 1958
Pure Oil Co.	Tellepsen Petro-Chem. Constrs.	—	Lemont, Ill.	Revamp Polymer & Girbtl	—	—	1958
	"	—	"	Revamp Gas Recov & Crude Dist	—	—	"
	"	—	"	Odorless Nap	—	—	"
Richfield Oil Corp.	Fluor Corp.	—	Watson, Cal.	Benz-Toluene	6000 BPD	—	May 1958
Rothschild Oil Co.	C. F. Braun & Co.	—	Puget Sound, Wash.	Refinery	50,000 BPD	—	1965
			Santa Fe Springs, Cal.	Cat Crack	8000 BPD	$2,000,000	—
R. J. Oil & Ref. Co.	Staff	UOP	Princeton, Ind.	Crude(Revamp)	5000 BPD	—	1959
	Staff	"	"	Platform	1200 BPD	—	"
	Staff	"	"	Unifin	1200 BPD	—	"
Shamrock Oil & Gas Corp.	Leonard Constr. Co.	Phillips Petr. Co.	Dumas, Tex.	Butane Isom	2000 BPD	—	—
Shell Chem. Corp.	—	—	Houston, Tex.	Isopro Alcohol	20 MM lb/yr	—	1958
Shell Oil Co.	Fruin-Colnon Constr. Co.	Sumner Sollitt Co.	Wood River, Ill.	Lube Pkg Whse, Ship Fac	—	—	Jan. 1958
	Kaiser Engrs.	UOP	Wilmington, Cal.	Platform	16,000 BPD	—	Early 1958
	"	Same & UOP	Domingues, Cal.	Platform-Unifin	0.5 MM gal/D	—	"
	Fluor Corp.	—	Anacortes, Wash.	Alkylation	2400 BPD	—	Mid 1958
	Procon, Inc.	Same & UOP	Norco, La.	Platform-Unifin	12,000 BPD	—	Summer 1958
Signal Oil & Gas Co.	Hudson Engrg. Co.	—	Healdton, Okla.	Nat Gaso Expan	—	$250,000	Mar. 1958
	Hammond Tank Co.	—	Tioga, N. D.	Nat Gaso Expan	—	$200,000	July 1958
Sinclair Oil & Gas Co.	—	—	Covington, Okla.	Deisobut	20,000 gal/day	—	Jan. 1958
	—	—	Lea Co., N. M.	Nat Gaso	10 MMCFD	—	Fall 1958
	—	—	Taft, Tex.	1100-hp Compr	—	—	—
Sinclair Ref. Co.	Fluor Corp.	—	Corpus Christi, Tex.	Gaso Frac	10,000 BPD	—	Early 1958
	Badger Mfg. Co.	Texaco Lic.	E. Chicago, Ill.	MEK Dewax-Decil-Vac Dist	1000 BPD	—	Late 1958
Sioux Oil Co.	Staff	—	Newcastle, Wyo.	LPG	—	$200,000	Jan. 1958
Skelly Oil Co.	Staff	—	Medicine Lodge, Kans.	Nat Gaso Expan	40,000 gal/day	—	Jan. 1958
	Staff	Same & Phillips Petr. Co.	Eldorado, Kans.	HF Alky	3-4000 BPD	—	Early 1958
	—	—	Schafer, Kans.	Expansion	—	—	1958
	—	Phillips Petr. Co.	Eldorado, Kans.	Alkylation	3500 BPD	—	"
	—	UOP	"	Platform	10,000 BPD	—	"
	—	—	"	Vac Dist	12,000 BPD	—	"
Socony Mobil Oil Co.	Fluor Corp., Ltd.	Same	Trenton, Mich.	H2SO4 Alky	3500 BPD	$3,500,000	Early 1958
	—	—	"	Sovaform	9000 BPD	$2,500,000	"
	J. F. Pritchard & Co.	Same & Socony Mobil	Augusta, Kans.	Sovaform	9000 BPD	—	Early 1958
	"	"	Casper, Wyo.	Sovaform-Fuel Oil Hydrodesulf	3000 BPD	—	"
	Lummus Co.	—	Paulsboro, N. J.	Delayed Coker	3250 BPD	—	"
	—	—	Princeton, N. J.	Research Lab	19,000 BPD	—	Early 1959
The Southland Co.	—	—	Black Point, Fla.	Refinery	—	—	—
Spencer Chem. Co.		Fauser-Montecatini Proc.	Henderson, Ky.	Urea	15,000 BPD	$12,000,000	1959
	Quaker Valley Constr.	—	Orange, Tex.	Polyeth Expan	100 T/D	—	Mid 1958
Standard Oil Co. of Cal.	—	—	Richmond, Cal.	Paraxylene	90 MM lb/yr	—	Mid 1958
	Bechtel Corp.	—	"	Cat Reform	25 MM lb/yr	$3,000,000	Early 1958
	—	—	Bakersfield, Cal.	Cat Reform	20,000 BPD	$11,000,000	Mid 1958
	Fluor Corp.	—	El Segundo, Cal.	Steam Gen	—	—	"
	Bechtel Corp.	—	Mulkiteo, Wash.	Refinery	275,000 lb/hr	$2,000,000	Mar. 1959
Standard Oil Co. (Ind.)	Foster Wheeler Corp.	Staff	Neodesha, Kans.	Ultraform	60,000 BPD	$75,000,000	1958
	Arthur G. McKee Co.	Staff	Whiting, Ind.	Ultraform #3	21,000 BPD	—	Early 1958

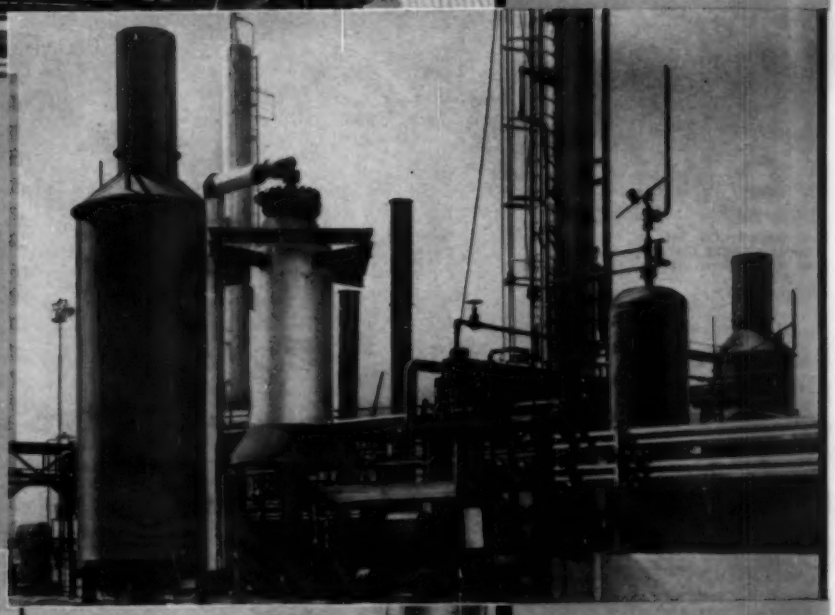
Owner-Operating Company	Construction Company	Engineering and Design Company	Location	Type of Plant or Unit	Rated Capacity	Cost	Scheduled for Completion
	Foster Wheeler Corp.	Phillips Petr. Co.	Mandon, N. D.	Alkylation	1600 BPD	—	Fall 1958
	Arthur G. McKee Co.	—	Wood River, Ill.	Fluid Cat Crack	30,000 BPD	—	Early 1959
	"	—	"	Crude	67,500 BPD	—	Early 1959
	"	—	"	Crude	140,000 BPD	—	1959
	—	Staff & Sumner Sollitt Co.	Whiting, Ind.	Research Lab	—	$8,000,000	—
Standard Oil Co. (Ohio)	O. L. Olsen Co.	—	Elmore, Okla.	Nat Gaso Exp	8000 MCFD	$350,000	Feb. 1958
	Arthur G. McKee Co.	Same	Cleveland, O.	Alkylation	3000 BPD	$3,000,000	May 1958
	"	Esso Res & Engrg. Co. Lic.	Cleveland, O.	SF Alky	3750 BPD	$2,400,000	May 1958
	M. W. Kellogg Co.	Same	Toledo, O.	Alky, Atm & Vac Dist, Delayed Coking, Cat Crack, Cat Poly, Cat Reform, Recov, Treating, Gaso Blend, Stm Gen, Hydrogen	60,000 BPD	$40,000,000	1958
	—	—	Latonia, Ky.	Asphalt (Conv)	—	—	—
Stauffer Chem. Co.	—	—	Hammond, Ind.	Sulf Acid	400 T/D	$4,000,000	July 1958
	—	—	Baytown, Tex.	Sulf Recov Exp	Double Cap	—	Early 1958
Straits Ref. Co.	Tears Engineers	—	Tacoma, Wash.	Refinery	10,000 BPD	$26,400,000	—
Sun Oil Co.	Catalytic Constr. Co. & Staff	—	Toledo, O.	Alky Expan	—	$1,000,000	Dec. 1958
Sunshine States Ref.	Kaiser Engineers	—	Tampa, Fla.	Refinery	20,000 BPD	$27,000,000	Fall 1959
Suntide Ref. Co.	Staff	UOP	Corpus Christi, Tex.	Gas Recov	2000 BPD	$275,000	May 1958
Tennessee Gas Trans. Co.	O. L. Olsen Co.	—	Lea Co., N. M.	Nat Gaso	10 MMCFD	$2,000,000	Early 1958
	"	—	Lovington, N. M.	Nat Gaso	16 MMCFD	$2,000,000	"
The Texas Co.	—	—	Beacon, N. Y.	Nuclear Rad Lab	—	—	Apr. 1958
	Fluor Corp., Ltd.	—	Port Arthur, Tex.	Cat Crack	90,000 BPD	—	Early 1958
	"	Same	"	Vac Pipestill	80,000 BPD	—	"
	—	UOP	"	Cat Reform	20,000 BPD	—	Late 1958
	—	UOP	"	Udex	28,000 BPD	—	"
	Bechtel Corp.	—	Anacortes, Wash.	Alkylation	—	—	Jan. 1959
	"	Chi. Brdg & Iron Works-Tankage	"	Refinery	40,000 BPD	$60,000,000	Jan. 1959
	"	"	"	Cat Crack	18,000 BPD	—	"
	Process Units	"	"	Cat Reform	7000 BPD	—	"
	"	"	"	Platform	7000 BPD	—	"
	"	"	"	Polymer	—	—	"
			(With Gulf, Phillips, Superior, Pan-American, Shell & Humble				
	—	—	Four Corners Area	Nat Gaso	—	Multi-Mil	—
Texas Eastman Co., Div. Eastman Kodak Co.	—	—	Longview, Tex.	Polyeth	Increase to 55 MM lb/yr	—	—
Texas—U. S. Chem. Co.	Foster Wheeler Corp..	—	Port Neches, Tex.	Buta Expan	Incr to 300,000 T/yr	Multi-Mil	—
Tidewater Oil Co.	Bechtel Corp.	Same & Houdry Proc. Corp.	Avon, Cal.	Houdriform	22,500 BPD	—	Jan. 1958
	O. L. Olsen Co.	Same	New Hope, Tex.	Low-Temp Stage Sep	15 MMCFD	$1,300,000	Feb. 1958
	Bechtel Corp.	—	Avon, Cal.	Steam	500,000 lb/hr	—	Fall 1958
Union Carbide Chem. Co.	—	—	Institute, W. Va.	Acrylonitrile	—	—	1958
	—	—	"	Fluorocarb	50 MM lb/yr	—	"
Union Carbide Corp.	—	—	Putnam Co., W. Va.	Petrochem	150 MM lb/yr	—	1960
Union Oil Co. of Cal.	C. F. Braun & Co.	Same & UOP	Wilmington, Cal.	Platform-Unifin	14,500 BPD 15,750 BPD	$12,000,000	—
United Fuel Gas Co.	J. F. Pritchard & Co.	—	Kenova, W. Va.	Gaso Recov	—	$8,000,000	Late 1958
United Rubber & Chem. Co.	Day & Zimmer, Tellepsen Petro-Chem. Constrs.	—	Baytown, Tex.	Syn Rubber	—	—	1958
Utah Oil Ref. Co.	Stearns-Roger Mfg. Co.	Babcock & Wilcox Co.	Salt Lake City, Utah	CO Boiler	138,000 lb/hr	$1,000,000	Apr. 1958
	Fluor Corp., Ltd.	Same	"	Crude Unit	6000 BPD	$2,125,000	Mid 1958
Vickers Pet. Co., Inc.	Procon, Inc.	UOP	Potwin, Kans.	Udex	15 MM gal/yr	$2,000,000	Early 1958
Warren Petr. Corp.	—	—	Forgan, Okla.	Nat Gaso	—	$2,000,000	Mid 1958
Western States Ref. Co.	Staff	Houdry Proc. Corp.	N. Salt Lake City, Utah	Cat Reform	1000 BPD	$400,000	Early 1958
Westland Oil Co.	—	UOP	Williston, N. D.	Platform	600 BPD	$300,000	Feb. 1958
Wiseco Proc. Plant, Inc.	O. L. Olsen Co.	—	Wise Co., Tex.	Nat Gaso	150 MMCFD	$3,700,000	Early 1958
Wyandotte Chem. Corp.	Fluor Corp., Ltd.	Same	Baton Rouge, La.	Chlorine-Caustic	—	$20,000,000	Late 1958
	Lummus Co.	Same & Shell Dev. Co.	Geismar, La.	Eth Oxide	60 MM lb/yr	—	—
	—	—	Wyandotte, Mich.	Petrochem	—	$3,000,000	—

FOREIGN CONSTRUCTION

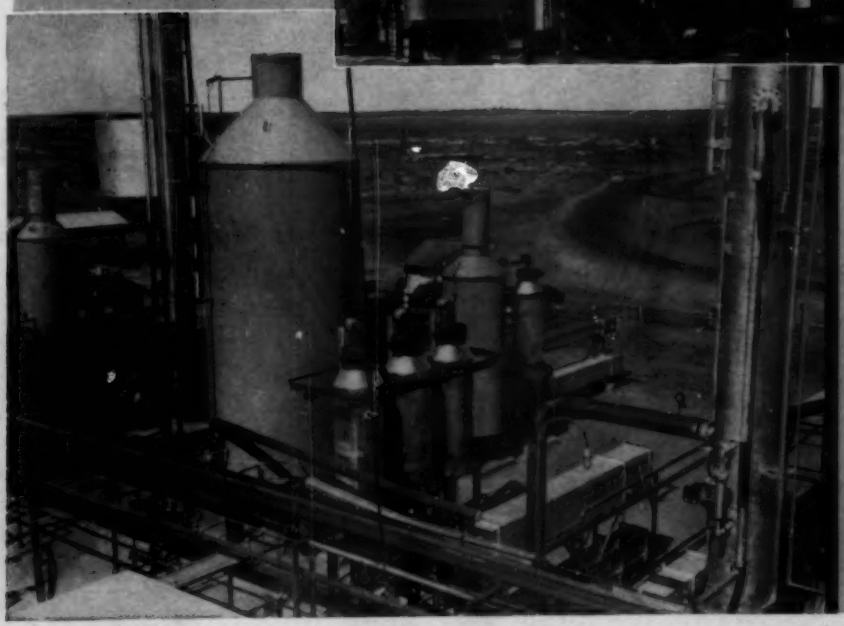
Owner-Operating Company	Construction Company	Engineering and Design Company	Location	Type of Plant or Unit	Rated Capacity	Cost	Scheduled for Completion
Air Liquid Co. of Paris	—	—	Takoradi, Afr.	Oxy Acetylene	—	—	—
Alaska-Yukon Ref. & Distr., Ltd.	Ref. Engrg. Co.	—	Haines, Alas.	Refinery	7500 BPD	$6,000,000	1958
Alba	—	—	Cubatao, Bras.	Methanol	—	$3,500,000	1958
	—	—	"	Formald	—	—	"
	—	—	"	Synth Resins	—	—	"
ANCAP (Admin. Nacional de Combust. Alcohol y Portland LaTeja)	—	—	Montevideo, Urug.	Crude Expan	28,000 BPD	—	—
				Vac Unit	10,000 BPD	—	—
				Cat Crack	5000 BPD	—	—
				Cat Reform	3000 BPD	—	—
				Gaso Treat	4500 BPD	—	—
				Gaso Stab	—	—	—



The vessel in the center is a gas fired updraft heater serving our Platforming unit. Three smaller vessels immediately in front of the heater are the Platforming reactors.



The vessel on the left is a heater and the structure on the right is a reactor of the UOP Unifining unit used in preparing the feed for our Platforming unit.



Shown here is the circular updraft heater and three reactors of our Platforming unit. Here you have an excellent view of the great New Mexico desert.

FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

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Famariss Produces High Octane Products From Platforming-Unifining Units

By Walter Famariss, Jr.
President
Famariss Oil and Refining Company
Hobbs, New Mexico

We have perhaps one of the smallest refineries marketing a finished product on the local level. Regardless of our size we are aware of our responsibility to offer customers a high octane number product consistent with the demands of today's high compression automobiles. Our search for a process to give us a high quality product plus low initial and operating costs led us to the Platforming process. In 1955 we placed on stream a 750 B/SD Platforming unit. To prepare the feed for the Platforming unit a 1000 B/SD Unifining unit was also installed.

Walter Famariss, Jr.

Famariss Raises Octane Number

With the addition of these units we were able to increase the octane number of our straight run gasoline from 68 RON to 97-98 RON giving our customers a quality product meeting the highest standards in our area. These new units enabled us to boost our total refinery throughput to 2,250 B/SD. Presently we are planning to expand our capacity 50 percent. Catalytic Cracking and additional Unifining facilities are processes being considered. The additional Unifining unit will be used for the treating of intermediates permitting us to enter new markets, thus substantially increasing the value of these products.

Growth Necessitates New Facilities

Perhaps you would be interested in our early growth and problems prior to the installation of the Platforming-Unifining units. Famariss Oil and Refining Company was formed in 1947 as an outlet for the marketing of a small amount of crude I was handling in this area. In 1949 we leased a small refinery at Monument, New Mexico, and in August we started operation of the refinery processing 450 barrels of oil per stream day. Market demands quickly exceeded this production. We therefore gradually increased production to the refinery's apparent maximum limit of 750 B/SD.

During this period all of our production was sold to other refineries for further processing. In 1951 we completed facilities for adding tetraethyl lead and the consequent tankage to enable our refinery to manufacture finished gasoline. We were then able to sell our motor fuel locally. So successful was our operation that in 1952 we purchased the Monument refinery from the leasor. We dismantled the refinery and moved the various structures and equipment one-half mile to a new location on our property. In just 90 days we were once again in production; this time throughput was increased to 1,200 B/SD.

UOP Aids In Solution Of Process Problems

But soon again we faced the problem of increasing production to meet the rising demands of our marketing area—an area which includes all of New Mexico, West Texas and the eastern portion of Arizona. Yes, demand for our motor fuel was increasing but so were compression ratios of automobiles requiring a higher and higher octane number gasoline. This can be an excessively costly problem for a small refiner. In this regard we met with engineers of Universal Oil Products Company, licensor of petroleum refining processes. UOP analyzed our needs in view of our economic and financial framework and suggested the Platforming unit—with a Unifining unit to prepare the feed stock for more efficient processing in the Platformer. We are happy to report that this was an ideal solution. Originally designed for research octane number production of 93.5 we were able to produce a gasoline of 97-98 research octane number by increasing the severity rate somewhat, yet allowing for further octane number increases if desired.

In Operation

The charge to the combination Platforming-Unifining unit—60% locally produced condensate and 40% straight-run gasoline—is prefractionated to produce a 150-400° F., 56° API heart cut. This is the liquid portion of the feed to Unifining. Excess hydrogen (from Platforming) joins this stream, is preheated, brought to reaction temperature in a fired heater, then enters the reactor and subsequently, a high pressure separator. Here any excess hydrogen is vented to the fuel gas system. The liquid product goes to a low pressure separator and thence to a stripper where the H_2S is removed overhead. The bottom product is the Platformer charge.

Our company is marketing three grades of gasoline—premium, regular and government grade. Bottoms from the prefractionator are being marketed as sand fracturing oil, which is finding increasing usage in revitalizing low producing oil wells.

Here at Famariss Oil and Refining Company we are looking into the future confident that whatever the motor fuel requirements of our customers may be we will continue to produce products meeting the highest competitive standards.

Octane number of straight run gasoline increased nearly 50% for Famariss with UOP Platforming® and UOP Unifining* processes

designed, engineered and licensed by

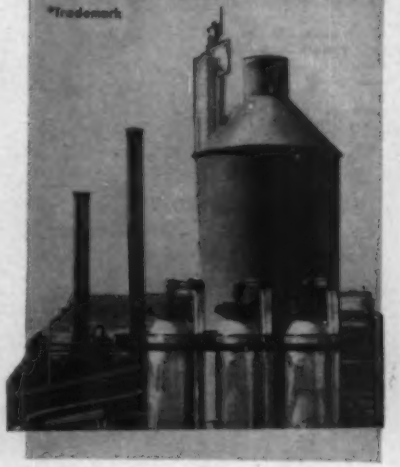
UNIVERSAL OIL PRODUCTS COMPANY

UOP

30 ALGONQUIN ROAD
DES PLAINES, ILL., U.S.A.

More Than Forty Years Of Leadership In Petroleum Refining Technology

*Trademark



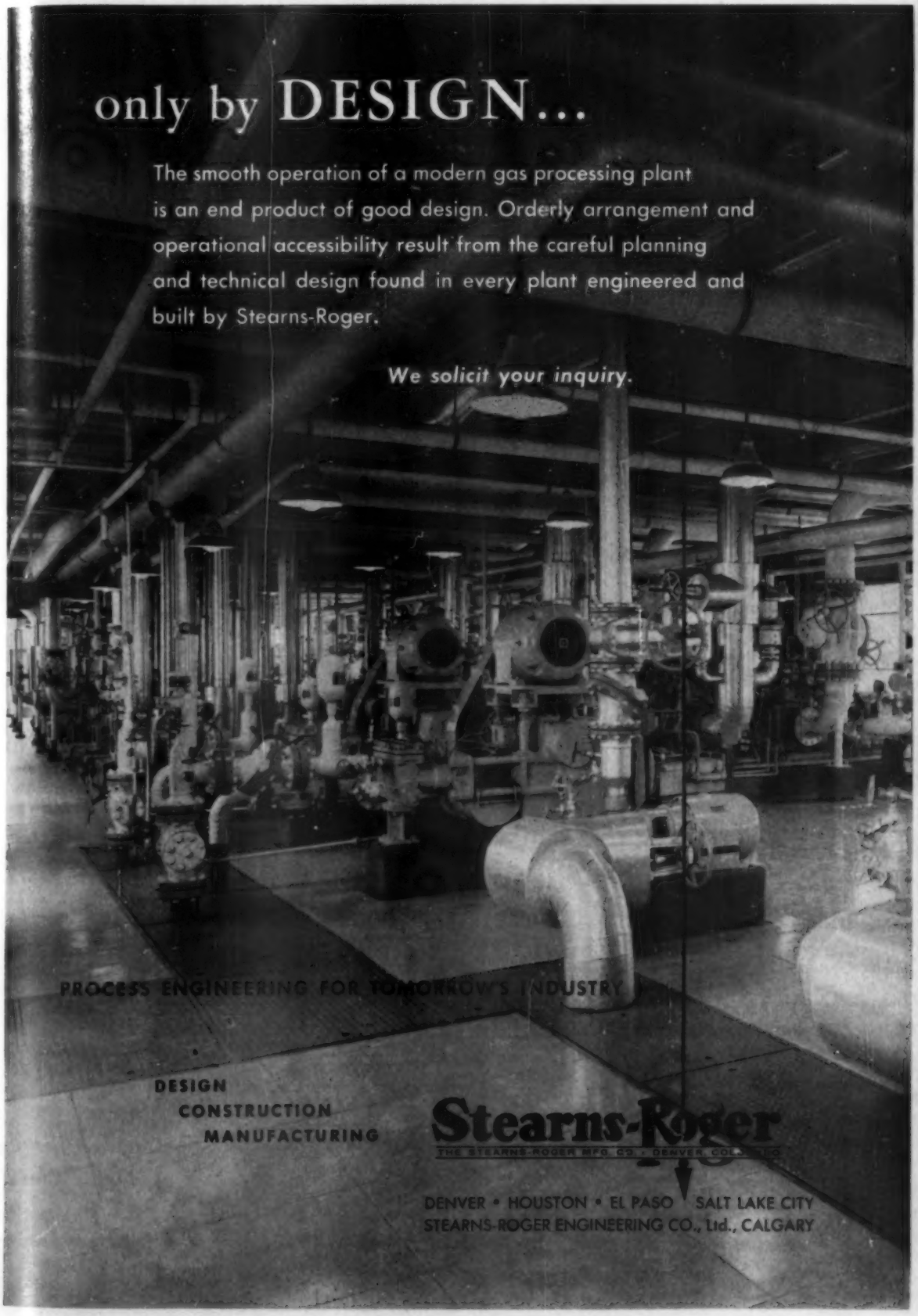
FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

Owner-Operating Company	Construction Company	Engineering and Design Company	Location	Type of Plant or Unit	Rated Capacity	Cost	Schedule for Completion
Anic of Italy	Houdry Proc. Corp.	Same	Ravenna, It.	Dehydrogen	20,000 T/yr	—	—
	Soc. Belge de L'Azote	Same & Koppers Co., Inc. Proc.	"	Styrene Mon	14,000 T/yr	—	—
Batanfsche Petr. Mij	—	—	Pernis, Holland	Alkylation	2800 BPD	—	Mid 1958
	—	—	"	Hydrodesul (2)	24,200 BPD	—	Mid 1958
	—	—	"	Cat Reform	12,700 BPD	—	"
Berry Wiggins & Co., Ltd.	Head Wrightson Proc. Ltd.	Same	Weaste, Manchester, Eng.	Refinery Expan	500 BPD	—	—
Bitumen & Oil Ref. (Aust.) Ltd.	Procon, Inc.	—	Sydney, Austr.	2-Stage Crude	12,000 BPD	$1,200,000	—
BP Benzin un Petr. & Farbenfabriken Bayer	—	—	Dormagen, Ger.	Petrochem	—	$56,000,000	—
BP Refinery (Kwinana) Ltd.	Kellogg Internatl. Corp.	—	Kwinana, W. Austr.	Cat Reform	10,000 BPD	$7,840,000	Dec. 1958
British Amer. Oil Co., Ltd.	Procon, Inc.	—	Montreal, Can.	Gas Recov	12,000 BPD	$750,000	Mar. 1958
	Lummus Co.	Atlantic Ref. Co.	Edmonton, Can.	Cat Desulf	6300 BPD	—	Early 1958
	"	"	Moose Jaw, Can.	Cat Reform & Hydrodesulf	5400 BPD	$4,000,000	Late 1958
	M. W. Kellogg Co.	Same	Moody, Can.	Crude	20,000 BPD	—	Late 1958
				Cat Cracking	9000 BPD	—	—
				Vac Dist	—	—	—
				Cat Reform	—	—	—
				Alkylation	—	—	—
				Hydrodesulf	—	—	—
British Hydrocarb. Chem. Ltd.	—	—	Grangemouth, Scot.	Polyeth	25 MM lb/yr	—	—
British Petr. Benlin und Petr. GMbH & Farbenfarbriken Bayer	—	—	Dormagen, Ger.	Petrochem	80,000 BPD	$83,000,000	1960
British Petr. Co.	Middle East, Bechtel Corp. & Geo. Wimpey & Co.	M. W. Kellogg Co.	Aden, Arabia	Thermal Reform	12,000 BPD	$8,400,000	Early 1958
	—	—	Grangemouth, Scot	Crude Dist	62,000 BPD	$12,000,000	1959
	Head Wrightson Proc., Ltd.	Same	Pernis, Holland	Gas	1900 T/D (Liq. Feed)	—	—
	Richard Costain, Ltd.	—	Sunbury, Eng.	Laboratory	—	$1,200,000	Early 1958
	Geo. Wimpey & Co.	E. B. Badger & Sons, M. W. Kellogg Co. & UOP	Isle of Grain Kent, Eng.	Refinery Expan	2.5 MMT/yr	$26,000,000	—
	Geo. Wimpey & Co. & Sir Robt. McAlpine & Sons	E. B. Badger & Sons	"	Distillation	90,000 BPD	—	—
	"	"	"	Cat Reform	10,000 BPD	—	—
	"	"	"	Therml Reform	10,000 BPD		
	"	"	"	Hydrofin (2)	10,000 BPD ea.	—	—
	"	"	"	Stabilizer	12,000 BPD	—	—
	"	"	"	Solutizers (2)	2000 BPD ea	—	—
	"	"	"	Copper Chlor(2)	8000 BPD ea	—	—
	"	"	"	Alkylation	2250 BPD	—	—
	—	—	Ger. Ruhr Area	Refinery	80,000 BPD	$83,000,000	1960
British Petr. Co., Ltd.	—	—	Hamburg, Ger.	Hydrofin	400,000 T/yr	—	—
	—	—	"	Cat Reform	350,000 T/yr	—	—
British Petr. Co. & Petrofina	—	—	Antwerp, Belg.	Hydrofin	10,000 BPD	—	1958
	—	—	"	Cat Reform	10,000 BPD	—	"
British Petr. Co. (Can.), Ltd.	—	—	Montreal, Quebec, Can.	Refinery	30,000 BPD	$30,000,000	—
Canadian Husky Oil Co., Ltd.	Poole-Pritchard, Ltd.	Husky Oil Co.	Ft. William, Can.	Diesulform	1000 BPD	$300,000	Jan. 1958
Canadian Industries Ltd.	Poole Constr. Co., Ltd.	Imperial Chem. Ind.	Edmonton, Alta, Can.	Polymer	18 MM lb/yr	—	1959
Canadian Oil Co's., Ltd.	M. W. Kellogg Co.	—	Sarnia, Ont, Can.	Crude	20,000 BPD	$4,000,000	Early 1959
Canadian Petrofina, Ltd.	—	—	Montreal, Que., Can.	Expansion	20,000 to 30,000 BPD	—	1958
	—	—	Montreal E, Que., Can.	Coking Unit	140 T/D	—	—
Canadian Southern Oils	—	—	Sask., Can.	Refinery	10-20,000 BPD	$7-10,000,000	—
Carbide Chem. Co.	Angus-Robertson & Foundation Co.	—	Montreal E., Que., Can.	Olefin Expan	3200 MCFD	—	Mar. 1958
	"	—	"	Polyeth Expan	34 MM lb/yr	—	—
Chemische Werke Huls A. G.	Staff	Houdry Proc. Corp. Esso Res. & Engrg. Co. & Firestone	West Germany	Syn Rubber	45,000 T/yr	$24,000,000	Mid 1958
	Firma Still, Recklinghausen	Houdry Proc. Corp.	Marl, Kreis Recklinghausen, W. Ger.	Dehydrogen (Buta)	40,000 T/yr	—	—
Chinese Petro. Corp.	Pintsch Bamag A.G.	—	Kaohsiung, Taiwan	Sulf Recov	10 Metric T/D	$300,000	1958
	Badger Mfg. Co.	The Texas Co.	"	Alkylation	900 BPD	$1,600,000	1958
Cities Serv. Oil Co., Ltd.	C. F. Braun & Co.	—	Bronte, Ont., Can.	Refinery	20,000 BPD	$27,000,000	Jan. 1959
Colombian Petr. Co.	—	—	Colombia, S. A.	Gas Proc.	—	$5,000,000	—
Compagnie Francaise de Raffinage	Foster Wheeler Corp.	Atlantic Ref. Co.	Provence, France	Powerform	20,000 BPD	—	Mid 1958
	M. W. Kellogg Co.	—	Normandie, France	Ethylene	30,000 T/yr	—	Early 1959
Compagnie de Raffinage, Shell Berre	—	—	Petit Couronne, France	Cat Reform	13,000 BPD	—	Late 1959
	—	—	"	Hydrodesulf	11,000 BPD	—	Fall 1958
	—	—	"	Crude	39,000 BPD	—	Mid 1958
Consumers Coop. Ref. Ltd.	Fluor Corp. & UOP	UOP	Regina, Sask., Can.	LP Coking	145 T/D	$1,300,000	Oct. 1958
Creole Petr. Corp.	—	Tellepsen Petro-Chem. Constr.	Ule, Zulia, Venez.	LPG	17,130 BPD	—	Feb. 1958
	Foster Wheeler Corp.	Same & Esso Res. & Engrg. Co.	Amuay, Venez.	Lube Phenol Extract Propane Dewax	700 BPD	—	1958
	"	Same	"	Hydrofin	17,000 BPD	$3,000,000	Feb. 1958
Destillerie Italiane	Unde Corp.	Hoesebt	Milan, Italy	Butanol	11,000 T/yr	—	—
Deutsche Erdol A. G.	Procon, Ltd.	UOP	Heide, Ger.	Platform-Unifin	4000 BPD	—	Mid 1958
Deutsche Shell, A. G.	—	—	Harburg, Ger.	Refinery	40,000 BPD	—	Late 1958
	—	—	Hamburg-Harburg, Ger.	Cat Crack	11,000 BPD	—	—
	—	—	"	Cat Poly	400 BPD	—	—
	—	—	Godorf, Ger.	Refinery	80,000 BPD	—	Late 1960
Dominion Tar & Chem. Co., Ltd.	Can. Badger Co., Ltd.	—	Hamilton, Ont., Can.	Tar Dist	15 MM Imp Gal/yr	—	—
Dow Chem. Co.	Bechtel Corp.	Same	Bombay, India	Polystyrene	300 T/yr	—	—

only by DESIGN...

The smooth operation of a modern gas processing plant is an end product of good design. Orderly arrangement and operational accessibility result from the careful planning and technical design found in every plant engineered and built by Stearns-Roger.

We solicit your inquiry.



PROCESS ENGINEERING FOR TOMORROW'S INDUSTRY

DESIGN
CONSTRUCTION
MANUFACTURING

Stearns-Roger

THE STEARNS-ROGER MFG. CO. • DENVER, COLO.

DENVER • HOUSTON • EL PASO • SALT LAKE CITY
STEARNS-ROGER ENGINEERING CO., Ltd., CALGARY

Owner-Operating Company	Construction Company	Engineering and Design Company	Location	Type of Plant or Unit	Rated Capacity	Cost	Scheduled for Complet
Edison Co. of Italy (SINCAT)	—	Foster Wheeler Corp.	Priolo, Sicily	Ammonia Syn Gas Gen	150 Met T/D	—	—
Egyptian Government	—	—	Assuan Dam, Egypt	Ammonia	1200 T/D	—	—
Egyptian Government Petr. Ref., Ltd.	—	—	Suez	Hydrodesulf	400 T/yr	$1,500,000	Dec. 19
	Petrolite-CTIP (Italy)	Petrolite	"	Dehydration	4000 T/D	$250,000	"
	Lummus Co.	—	"	Sulf Recov	100 T/D	$500,000	"
	—	—	"	Lube Oil	60,000 T/yr	$10,000,000	Dec. 19
Esso A. G.	C. F. Braun & Co.	Esso Res. & Engrg. Co.	Cologne, Ger.	Refinery	72,000 BPD	$39,000,000	Jan. 19
Esso Belgium	Badger-Comprimo N. V.	Esso Res. & Engrg. Co.	Antwerp, Belg.	Powerform	5000 BPD	$6,000,000	Mid 19
	"	"	"	Hydrofin	6000 BPD	$1,100,000	"
	"	"	"	Vac Dist	2900 BPD	$750,000	"
Esso Nederland, N. V.	Badger-Comprimo N. V.	Esso Res. & Engrg. Co.	Rotterdam, Holland	Refin (Hydro-Skim)	100,000 BPD	$44,000,000	Jan. 1960
Esso Petro. Co., Ltd. Shellmex-British Petr-Caltex	—	—	Whitegate, Ire.	Refinery	11,200,000 B/yr	$25,000,000	Late 19
Esso Petr. Co., Ltd.	—	—	Fawley, Eng.	Crude Dist	70,000 BPD	$36,400,000	End 1958
	—	—	"	Auto Diesel Hydrofin (2)	—	—	—
	—	—	"	Sulf Recov	2800 T/yr	—	—
	—	—	"	Crude	50,000 BPD	—	—
Esso-Raffineriet Norge Clapp	—	—	Norway	Refinery	2 MM T/yr	$30,715,000	Summer 1960
Esso Standard Italiana	Compagnia Tecnica Industrie Petroli	Esso Res. & Engrg. Co.	Trieste, Italy	Powerform	1000 BPD	$850,000	Sept. 1958
Esso Standard S. A. F.	—	—	Ambes (Gironde), France	Refinery	1,500,000 T/yr	—	—
Farbenfabriken Bayer	—	Scientific Design Co., Inc.	Dormagen, Ger.	Crude Crack	20 MM lb/yr	—	—
Federated Coop., Ltd.	—	—	Regina, Sask., Can.	Crude Dist	16,000 BPD	—	1957-1958
	—	—	"	Thermal Crack (Revamp)	1000 BPD	—	"
Friesin Oil Co.	Ralph M. Parsons Co.	—	Emden, Ger.	Refinery	—	$17,500,000	Oct. 1959
Gas & Fuel Corp. of Austr., Ltd.	Head Wrightson Proc.	Same	Morwell, Austr.	Gas Dehyd	36 MMCFD	—	—
Gewerkschaft Erdoel-Raffinerie Elmsland	Lummus Co.	Houdry Proc. Corp.	Lingen, Ger.	Houdriform	3500 BPD	—	—
Government Oil Refineries Adm. of Iraq	Foster Wheeler Corp.	Same	Daura, Bagdad	Ref. Expan & Powerform	5000 BPD	—	—
W. R. Grace Co. - Farbwerke Hoechst	—	—	Sao Paulo, Bras.	Polyethylene	—	—	—
Idemitsu Kosan Co.	Japan Gaso Co.	UOP	Tokuyama, Jap.	Refinery	30,000 BPD	$25,000,000	—
Imperial Chem. Ind., Ltd.	M. W. Kellogg Co.	—	Wilton Eng.	Oil Cracker-Olefins	—	—	Early 1959
	Staff & Power Gas Co.	Texaco Lic.	Billingsham, Eng.	Ammonia	200 T/D	—	—
	—	—	Gloucestershire, Eng.	Chemicals	—	$280,000,000	—
	—	—	Sydney, Austr.	Polyethylene	—	$4,200,000	—
Imperial Oil Co., Ltd.	Bechtel Corp.	Same & C. F. Braun & Co.	Sarnia, Ont., Can.	Stm Crack & Assoc. Fac	150 MM lb/yr	$25,000,000	Mid 1958
	—	—	Calgary, Alta.,Can	Ref Expan	—	$17,000,000	—
Irish Ref. Co. Ltd.	Lummus Co.	—	Whitegate, Ire.	Refinery	40,000 BPD	$30,000,000	Mid 1959
Jefferson Lake Sulfur Co.	—	—	Calgary, Alta., Can.	Sulfur	350 T/D	—	—
Kent Oil Ref., Ltd.	—	—	Isle of Grain, Kent, Eng.	Platform-Cat Hydrogen-Alky-Vis-breaker	—	—	Late 1958
	—	—	"	Crude	50,000 BPD	—	—
	—	—	Grangemouth, Scot.	Expansion	20,000 BPD	—	Early 1959
Korean Government	Hydro. Res., Inc.	Same	Chung-Ju, Korea	Urea	135 T/D	$25,000,000	1958
Mitsubishi Petrochem. Co.	Basf	Same	Yokkaichi, Jap.	Chemicals	170 T/D	$28,000,000	1958
Mobil Oil A. G.	Lurgi	—	Bremen, Ger.	Sulf Recov	24 T/D	—	Feb. 1958
	Hydrocarb. Mineralolbau	—	"	Two-Stage Crude Dist	16,500 BPD	$2,700,000	Apr. 1958
Mobil Oil Co. Ltd.	Staff	—	Coryton, Eng.	Crude Expan	5000 BPD	—	May 1958
	Staff & John Brown Co.	—	"	LPG	31,500 LT/yr	$518,000	1959
	Staff	—	"	LPG Stor & Load Fac	—	$840,000	1960
Mobil Oil Franciase	Staff	—	Gravenchon, France	Cat Hydro-desulf	5000 BPD	—	Jan. 1958
	Staff	—	Frontignan, France	Cat Reform	3700 BPD	—	Mid 1959
	"	—	"	Hydrodesulf	5000 BPD	—	"
Mobil Oil Italiana	Staff	—	Naples, Italy	MEK Expan	—	—	Late 1958
	CTIP	—	"	Cat Reform	9000 BPD	—	"
	"	—	"	Hydrodesulf	10,000 BPD	—	"
Mobil Overseas Oil Co., Inc (Subsid. of Socony Mobil)	—	—	Turkey	Refinery	65,000 BPD	—	1960
A. P. Moller	Foster Wheeler Corp.	Same	Maersk-Copenhagen, Den.	Direct-Fired Heaters (2)	21,000 Met T/yr	—	—
Monsanto Chem. Ltd.	Sir Robt. McAlpine & Sons	—	Fawley, Southampton, Eng.	Polyeth	10,000 T/yr	$23,800,000	Mid 1959
Naphtachimie	—	Stone & Webster	Lavera, France	Eth Ox Expan	—	$17,500,000	—
National Iranian Oil Co.	Richard Costain, Ltd. & John Brown, Ltd.	NIOC	Kermanshah, Iran	Ref Expan	6850 BPD	$3,627,000	1958
Nippon Oil Co.	Japan Gaso. Co. & UOP	UOP	Niigata, Jap.	Platform	1600 BPD	$1,890,000	1958
Nippon Petrochem. Co.	Stone & Webster Can., Ltd.	—	Kawasaki, Japan	Ethylene-Butadiene	25,000 T/yr 5000 T/yr	$16,000,000	Early 1959
North Star Oil, Ltd.	—	—	St. Boniface, Can.	Unifin-Platform	2700 BPD	$1,500,000	Nov. 1958
Northwest Nitro-Chem., Ltd.	Ford, Bacon & Davis & Comm. Solv. Corp.	Saint-Gobain & Comm. Solv. Corp.	Medicine Hat, Alta, Can.	Ammon Nit	33,000 T/yr	$17,500,000	Jan. 1958
	"	"	"	Ammon Phos	65,000 T/yr	—	—
	"	"	"	Ammon Phos-Sulf	42,000 T/yr	—	—
	Fluor Corp.	Comm. Solv. Corp.	"	Phos Acid	—	—	—
Oesterr. Mineralolver, A.G.	—	—	Korneuberg, Aust.	Refinery	44,500 BPD	—	—
Pacific Petr., Ltd.	Stearns-Roger-Marwell	—	Taylor, B.C., Can.	Cat Desulf & Refiner	3800 BPD	$10,000,000	Jan. 1958
Panama Ref. & Petrochem. Co., Inc.	Foster Wheeler Corp.	Same	Portobelo, Pan.	Refinery	55,000 BPD	$33,000,000	June 1959

KING SIZE

This giant 37 ton Cat Poly Reactor is one of 4 units shipped to a large petroleum refinery in the State of Washington. It is 4'-3½" in diameter by 32'-0" long and has a 1 3/16" thick shell. Each of its 8" thick heads is attached to the shell channel with 28 special alloy stud bolts 2¾" diameter by 15¼" long having nuts 4¼" across the flats. Into the 5¾" thick tube sheets 190 tubes, 2½" O. D., No. 5 gauge and 30'-0" long, are rolled and seal welded. Designed for 1,230 lbs. pressure on the tube side, the reactor was completely X-rayed and stress relieved.

Vogt, a leading builder of shell and tube reactors for poly plants, has the competently skilled personnel and modern mechanical facilities with which to provide heat transfer equipment for the most exacting services in petroleum refineries, chemical plants, and related industries.

Reactors ... by Vogt

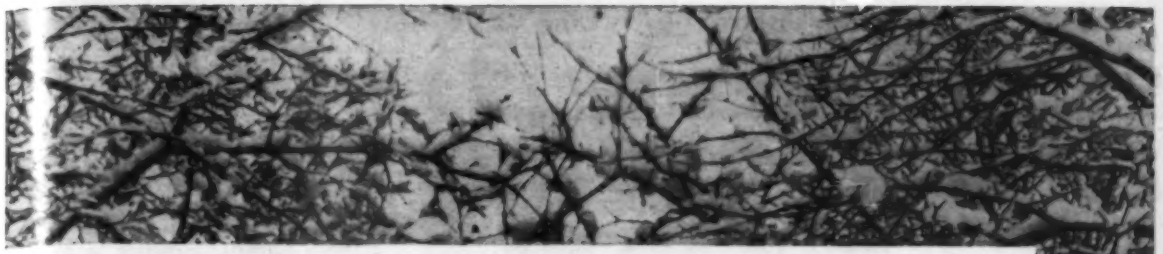
A bulletin describing the wide range of heat transfer equipment built by Vogt is available upon request.

24A-XRE

HENRY VOGT MACHINE CO., LOUISVILLE, KENTUCKY

BRANCH OFFICES: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA

Owner-Operating Company	Construction Company	Engineering and Design Company	Location	Type of Plant or Unit	Rated Capacity	Cost	Scheduled for Completion
Petroleos Mexicanos — Pemex	—	Phillips Petr. Co. Lic.	Mexico City, Mex.	Polyeth	15 MM lb/yr	—	1959
	Arthur G. McKee Co.	Same & Phillips Petr. Co.	Ciudad, Madero, Mex.	Alky-Poly	—	—	—
	"	"	"	Topping, etc	100,000 BPD	—	—
Petrofina (Soc. Raffineria Roma)	—	—	Rome, Italy	Modern	30,000 BPD	—	—
Petro. Chems., Ltd.	Lummus Co.	Same & Shell Dev. Co.	Partington, Eng.	Eth Oxide	60 MM lb/yr	—	—
Polychem Ltd.	—	—	Bombay, India	Polystyr (2)	6 MM lb/yr	—	—
Polymer Corp., Ltd.	Can. Gen. Elec.	Cat. Constr. Co.	Sarnia, Ont., Can.	Expansion	—	—	—
	—	—	Red Deer, Can.	Syn Rubber	—	Multi-Mil	—
Purfina Mineraloliraffiniere A. G.	Lummus Co.	UOP & Shell Dev. Co.	Duisburg, Ger.	Platform-Topping-Hydrodesulfur	20,000 BPD	—	Mar. 1959
Raffinerie Belge Des Petroles S. A.	Staff	—	Antwerp, Belg.	Crude	5000 BPD	—	1960
Refineria Panama	Petr. Comb. & Engrg. Co.	—	Las Minas Bay, Pan.	Ref & Petrochem	70,000 BPD	$59,000,000	1959
Royalite Oil Co., Ltd.	Ref. Engrg. Co.	UOP	Kamloops, B. C., Can.	Platform	1000 BPD	$750,000	Mar. 1958
	—	—	Mildred Lake, Alta., Can.	Tar Sands Ext	20,000 BPD	—	1960
	—	—	Turner Valley, Alta., Can.	Sulf Recov	38 LT/D	$366,000	—
	—	—	"	Propane	18,000 gal/D	$476,000	—
	—	—	"	Gasoline	100 MMCFD	$1,558,000	—
Saint-Gobain & Batignolles-Chatillon	—	Soc. Belge de L'Azote	Monclova, Mex.	Nitric Acid	—	—	—
Schloven-Chemie A. G.	—	—	Gelsenkirchen, Ger.	Expansion	To 2 MM T/yr	—	—
SF De Petroles BP	—	—	Lavera, France	Ethylene	To 18,000 T/yr	—	—
	—	—	"	Propylene	"	—	—
Shell Chem. Co., Ltd.	Lummus Co.	B.P.M. Comprimo Montecatini Pintsch Bamag-Lummus	Shell Haven, Eng.	Ammon & Fert	75,000 T/yr	$30,000,000	1958
Shell Co. of Vene.	—	—	Cardon, Venez.	Alkylation	2300 BPD	—	Mid 1958
	—	—	"	Steam Col	15,000 BPD	—	Late 1958
	—	—	"	Distill	80,000 BPD	$20,000,000	"
Shell Oil Co.	—	—	Calgary, Alta., Can.	Sulf Recov	300 T/D	—	1958
Shell Oil Co. (Can.), Ltd.	Ref. Engrg. Co.	Shell Dev. Co.	Montreal E., Can.	EPON Resin(R)	1500 T/yr	$1,000,000	Early 1958
	"	UOP & Shell Dev. Co.	"	H F Alky	400 BPD (Deterg) 1500 BPD (Gaso)	$4,000,000	"
	Staff	—	Shelburn Ref., B. C., Can.	Spec. Naph Dist	640 BPD	$600,000	Early 1958
Shell Ref. & Market. Co. Ltd.	E. B. Badger & Sons, Ltd.	Same	Shell Haven, Eng.	Distill	80,000 BPD	—	July 1958
	"	Same & Stone & Webster	"	Atm Dist	80,000 BPD	—	"
	—	UOP	"	Platform	6700 BPD	—	—
	—	—	"	Hydrodesulf	16,000 BPD	—	1960
Shell Ref. (Aust.) Pty., Ltd.	—	—	Clyde, Austr.	Cat Reform	6700 BPD	—	Mid 1958
	Werkspoor N. V.	Procon Inc.	"	Platform	5500 BPD	$13,440,000	"
	Simon-Carves (Austr.), Pty., Ltd.	Same	Geelong, Austr.	Sulf Acid	100 T/D	$896,000	Sept. 1958
	—	—	"	Hydrodesulf	11,000 BPD	—	Mid 1960
Sherritt-Gordon Mines, Ltd.	—	—	Ft. Sask. Alta., Can.	Anhyd Ammon (Planned)	75 T/D	$24,000,000	—
Showa Denko Kk, Tokyo	—	Foster Wheeler Corp.	Kawasaki, Jap.	Syn Gas	110 Met T/D	—	—
Soc. Financiere Italo-Suisse	—	—	Ticino Canton, Switz.	Refinery	—	—	—
Soc. du Caoutchouc Butyl	C. F. Braun & Co.	Esso Res. & Engrg. Co.	Seine Maritime, France	Isobutyl Ext & Butyl Rubber	20,000 T/yr	$16,000,000	Fall 1958
Soc. Industrielle Belge de Petroles	M. W. Kellogg Co.	UOP	Antwerp, Belg.	Cat Reform	10,000 BPD	—	Early 1960
	UOP	"	"	Hydrofin	10,000 BPD	—	"
SPA Tecnico Industriale Aquila	Staff	Staff	Trieste, Italy	Cat Crack	3300 BPD	—	—
	"	"	"	Cat Poly	1400 BPD	—	—
Standard Oil of Cal.	—	—	Oahu, Hawaii	Refinery	25,000 BPD	$30,000,000	—
Standard Vac. Oil Co.	—	—	Bombay, India	Expansion	33,000 BPD	$10,600,000	—
Standard Vac. Oil Co. of So. Afr., Pty., Ltd.	Foster Wheeler Corp.	Esso Res. & Engrg. Co.	Durban, S. Afr.	Powerform-Hydrofin-Power Fac	24,300 BPD	$9,500,000	1958
Standard Vac. Ref. Co. (Austr.) Pty., Ltd.	Fluor Corp.	Socony Mobil	Altona, Austr.	Crude Expan	41,000 BPD	$5,265,000	1959
	"	"	"	Cat Desulf	10,000 BPD	$2,800,000	"
Stanic Industria Petrolifera, SPA	CTIP	Esso Res. & Engrg. Co.	Bari, Italy	Hydrofin	8300 BPD	$850,000	June 1958
	—	"	"	Gas Oil Hydrofin	8000 BPD	$1,760,000	July 1958
	CTIP	"	Livorno, Italy	Hydrofin	8200 BPD	$1,000,000	Aug. 1958
	—	"	"	Gas Oil Hydrofin	8000 BPD	$1,600,000	Sept. 1958
Sumitomo Chem. Co., Ltd.	Stone & Webster Engrg. Corp.	—	—	Ethylene	—	—	—
Syrian Government	Czech. Techno-Export	—	Homs, Syria	Refinery	20,000 BPD	$15,200,000	Late 1959
Toa Nenryo Kogyo, Ltd.	Staff	Esso Res. & Engrg. Co.	Shimizu, Japan	Powerform-Hydrofin-Treat	34,000 BPD	$11,800,000	1959
Trinidad Oil Co., Ltd. (The Texas Co.)	Procon, Ltd.	UOP	Trinidad, B.W.I.	Platform-Unifin	8000 BPD	—	Early 1958
Turkish-American Oil Co.	M. W. Kellogg Co.	—	Istanbul, Turk.	Refinery	15,000 BPD	$18,000,000	Dec. 1958
Union Carbide Corp.	—	—	Santos, Bras.	Polyeth	—	—	—
Union Carbide Caribe	Brown & Root	—	Ponce, Puerto Rico	Eth Glycol	250 T/D	$25,500,000	1958
Union Carbide Internatl. Co.	Brown & Root	Same	Cubatao, Bras.	Polyeth	—	—	Early 1958
Venezuelan Government	Air Products, Inc	—	Venezuela	Air Separation	120 T/D Ammon	$1,000,000	—
	"	—	"	Hydrogen Pur	—	—	—
Wainwright Producers & Refiners, Ltd.	—	Ralph M. Parsons Co.	Alberta, Can.	Thermal Crack-Cat Reform-Desulf-Poly	—	—	—
X-L Refineries, Ltd.	B. D. Bohna & Co., Ltd. & E. V. Lane Corp.	Koch Engrg. Co., Inc.	Dawson Creek, B.C., Can.	Houdriform	300 BPD	—	—



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OPERATORS' FORUM

Cleaning Fouled Residuum Cooler

Q A heavy residuum cooler coil is fouled with solid and semi-solid material from the residue, sticks on fairly tenaciously, much of it not soluble in naphtha or kerosine. Can this be removed by typical methods, and if so, what is the routine?

C. D. T.

A Experience with removal of residues of heavy residuum deposited on cooler coils indicate necessity of following a two-step cleaning procedure, employing first hot cycle oil, followed by a heavy duty alkaline cleaner, mixed with water, to which is added an emulsifiable solvent detergent.

It is assumed the unit referred to is either an open-box type with 6-in. pipe (U-bend), approximately 24 ft long, 8 ft high and spaced a foot apart with 8 to 10 rows in the box, or, a closed, overhead box-type cooler, average size 4 ft by 6 ft. On the latter type unit, product would generally pass over the outside of coils with water on the inside. In the open-box unit, water will generally be on the outside with product circulating through interior of the coils.

This residue, as pointed out by inquirer, is not soluble in the light hydrocarbons like naphtha and kerosine, due largely to the presence of free carbon. This explains why hot cycle oil is recommended as the pre-cleaner.

The procedure or method would call for circulating cycle oil in a closed system, at a temperature of 350 to 370 F for a period of four hours. A pump capable of delivering 250 to 500 gal per min should be used. The next step would be to circulate hot water for 30 minutes to an hour. This is to be followed by 12 to 16 hours circulating of boiling solution of a heavy duty proprietory alkaline cleaner at one pound per gallon, to which is added 10 percent by volume of an emulsifiable solvent detergent.

Reversing the direction of flow each hour and agitating by injection of air or inert gas helps immeasurably to remove softened deposits. It is desirable to use agitation during the final rinsing period of approximately four hours, after which draining down and blowing out with air will complete the operation.

While corrosion and/or sulfide scale is not generally encountered, if, because of crude supply, this is part of the problem, consideration will have to be given to use of an acidic scale remover or an alkaline derusting material. In most cases this treatment would follow circulation of the hot cycle oil and regular alkaline-solvent cleaning solution recommended above. In some instances it may be possible to eliminate the second step in the procedure, following circulation of hot cycle oil with a rinse and then with the corrosion removing detergent solution.

R. E. Tschupp

New Panel Member . . .

R. E. (Ray) Tschupp *has joined the Operator's Forum Panel as an authority on chemical cleaning of processing equipment. Following college at New York University and Tusculm College, he spent several years with Dorr-Oliver Company, then joined Oakite Products, Inc. in 1949. He is now headquarters representative in Oakite's petroleum division.*

Treating Wax Distillate

Q What methods for treating wax distillate, including pretreating, after treating and distillation routines, can be employed to advantage to improve yield, quality and efficiency? What are the properties of the raw distillate that contribute most to wax recovery?

T. L. B.

A Crude oil contains two types of wax; paraffin wax associated with the distillates, and petrolatum present in the residuum. Paraffin wax is crystalline while the crystal structure of microcrystalline wax can be seen only under a microscope. The size of wax crystals determines the ease with which wax can be filtered. Dewaxing processes were discussed in Refining Fundamentals *(The Refining Engineer,* March 1956, p. C-70).

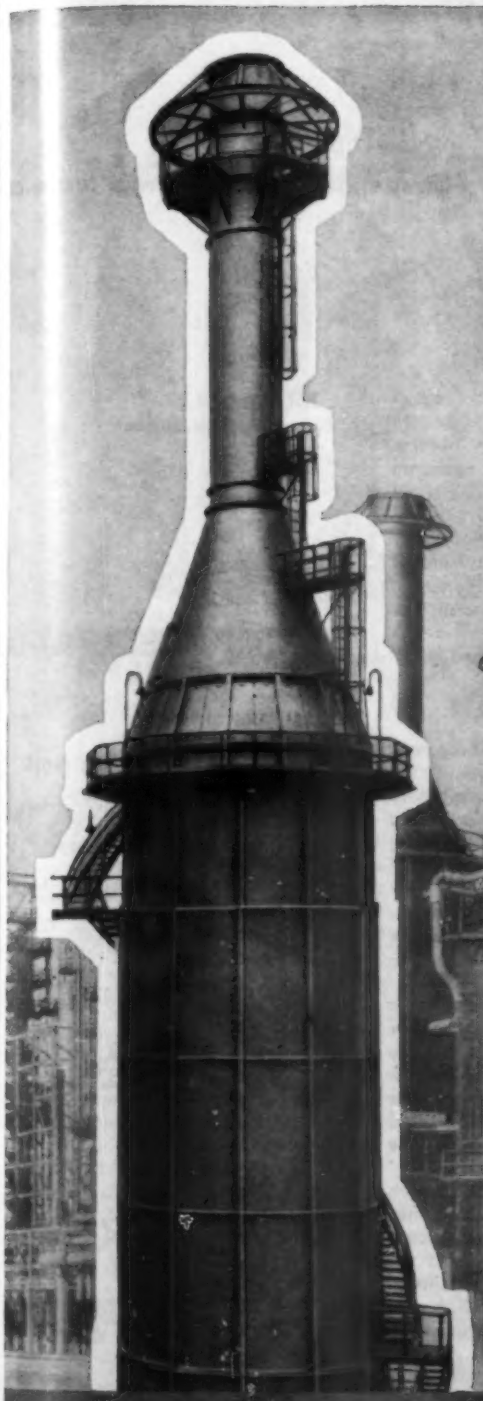
The size of wax crystals depends to a great extent on the boiling range of the wax distillate and the efficiency of fractionation. This is particularly important in filter pressing and in dewaxing with naphtha used as solvent to reduce viscosity of the oil at low temperatures. Wax distillate must be well fractionated and contain no heavy ends. The dividing line between the wax distillate and the heavier oil fractions is determined experimentally. Individual plants vary in establishing the border line between the pressable and unpressable distillates depending on the size of the available pressing equipment with respect to the volume of the oil processed. The border line depends also on the nature of crude oil.

Filtering rates might be improved by treating the paraffin distillate with a few pounds of sulfuric acid. This treatment removes from the distillate the oily materials which interfere with the crystallization of wax. However, this does not mean that all distillates can be made filterabie by chemical treatment and offset poor fractionation.

It also is possible to improve filter rates by adding to the oil small quantities of pour point depressants, like paraflow. This is not a universal remedy, however.

The above shows that preparation of wax distillate at the still and adjustments in the filter plant operations are most important for improving yield and quality of wax. Plants should not be operated above their capacity.

V. A. Kalichevsky



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CASTABLE REFRACTORIES KNOW-HOW

New tips on a dependable engineering material

L. J. Cormack
American Cyanamid Company

PROPER KNOWLEDGE of the limitations, applications, and advantages of castable refractories is necessary to proper usage. Because of lack of know-how, many maintenance and construction engineers are not using this material or have had previous disappointing results.

For example, many have experienced cracking and spalling in service. Why? In most cases, the fault lies in the method of application . . . properly applied, castables will neither spall or crack and it will last almost indefinitely.

There are a few basic rules that must be followed for successful application. Here are some of the more important ones:

Mixing. Castable refractory is usually packed dry in 100 lb bags and must be mixed with water before using. The manufacturer's mixing instructions on the bag or tag should be followed. As a rule, refractory can be mixed to three degrees of consistency — pouring, tamping, and ramming. *Pouring consistency* has enough water in the mixture to cause the material to flow and level out. *Tamping consistency* has just enough water added to the refractory to permit the material to be puddled into place with rods or sticks. *Ramming consistency* is dry with just enough water for the mixture to hold together when packed solid. This ramming mixture should be used with caution as the amount of water may not be enough to set all the hydraulic cement; if this happens, the finished refractory may be greatly lacking in strength.

Preventing cracks. Many installations of castable refractories have failed because of the expansion and contraction between the refractory and supporting structure. These failures can be reduced by coating the supports or bolts with paraffin or an asphalt mastic. These materials will melt or run out when heat is applied to the installation, leaving space for a small amount of movement which in most cases will take care of the differences in expansion.

Installing anchor bolts. Above all, the anchor bolts that hold the refractory in place should be staggered in length to prevent cleavage planes. One good way to do this is to maintain a one-inch variation in their length and every other bolt should be of different length. In no case should bolts of the same length be next to one another. Where possible the longest bolts should be at least two inches from the surface of the refractory. If the castable is a lining type and it is necessary to install bolts closer to the surface, an alloy bolt should be used to resist the high temperature.

How to cast peep holes. Where peep holes are needed, wooden plugs of the proper size can be installed before pouring the refractory. These plugs should be soaked overnight to prevent water absorption from the refractory with resulting swelling. Also this soaking ahead of time will facilitate the removal of the plugs and eliminate the swelling that could weaken the refractory.

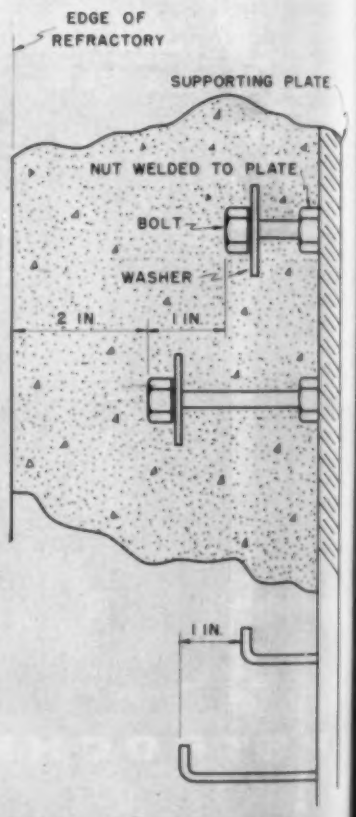
Pouring. The refractory should be poured as soon as it is mixed. Many failures can be traced to the practice of delaying the pouring until the refractory has partially set, then adding water to change its consistency. This will invariably cause the refractory to be structurally weak.

Curing. After the refractory has been poured and puddled to eliminate voids, the forms should remain undisturbed for at least 24 hours. Even after the forms have been removed, it should be allowed to air-dry for 48 hours. This prolonged air drying increases the materials strength.

Quick curing. If the material is needed quickly and 48 hours of curing is impossible, the drying and setting can be speeded up by punching or drilling ⅛-in. holes on 6 to 12 in. centers. This will facilitate drying and possibly prevent spalling.

Don't be afraid to gamble on castable refractories. Just follow the directions above and add a dash of horse sense and you can depend on your castable refractories lasting many years.

* * *



To prevent cleavage planes from developing, stagger the anchor bolts. Shown here are two methods of supporting the refractory. The one above uses bolts, nuts and washers, the lower one uses "L" shaped steel.

Now: the SBA-Kellogg way to

ACETYLENE

FROM NATURAL GAS OR NAPHTHA

Through special arrangement with Societe Belge de l'Azote (SBA), The M. W. Kellogg Company now can provide a continuous acetylene production process using naphtha or natural gas as feedstock. This improved process promises economies and results previously not obtainable.

Revolutionary Burner

The heart of this process is the SBA-developed burner. Easy to control, and requiring only minimum attention, it is stable and operates continuously—producing a constant yield. The formation of coke and tarry materials in the burner is virtually nonexistent. Any trace of these materials is automatically removed by special separation equipment.

Kellogg Cooperation

Through cooperative research and development by SBA and Kellogg, considerable engineering information has been developed on both the pyrolysis and purification systems. The results of this joint effort, available only from Kellogg, assure accurate and thoroughly reliable plant designs.

Process Highlights

Using naphtha feedstock, a wide range of ethylene to acetylene ratios may be achieved. This permits simultaneous production of ethylene and acetylene with great flexibility. In the case of natural gas feed, acetylene is the primary product—with negligible quantities of heavy impurities. If desired, the plant can be designed to operate on either feedstock.

Acetylene Purification

In the process train, the heavy acetylenes and hydrocarbons are removed first, leaving a stream containing acetylene and lighter materials. By using an SBA-developed ammonia absorption system, acetylene and ethylene are recovered from hydrogen and the other products of combustion, which in themselves are valuable by-products. The acetylene, 99.5% pure or higher, and ethylene are stripped from the ammonia. Ammonia makes this process safer than others because of its depressing effect on the explosibility of acetylene.

For More Information

Chemical companies and petroleum refiners interested in utilizing this advanced acetylene production process are invited to discuss their specific needs in person with The M. W. Kellogg Company. Please address inquiries to the Chemical Process Division.

CHEMICAL PROCESS DIVISION

The M. W. Kellogg Company

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Gas Chromatographer Versatile Analytical Tool In Refining-Petrochemical Operations

Cosden finds many new uses in process and product quality control

VAPOR PHASE chromatography has proved to be a valuable and versatile analytical tool for routine process control at Cosden Petroleum Corporation's Big Spring, Texas, refinery, according to company chemists. Cosden spokesmen G. K. Chadd and Glen White told the recent Southwestern Regional Meeting of the American Chemical Society that "with its use carefully controlled and limitations well understood . . . vapor phase chromatography can be considered one of the most important advances in analytical testing of the past decade."

Cosden uses a laboratory chromatograph for analysis of several gas and liquid feed and product streams at the Big Spring refinery. This refinery, rated at 30,000 bbl per day, is West Texas' largest. It is a complex plant, too. In addition to catalytic cracking, catalytic reforming, polymerization, and alkylation, the refinery is equipped with extensive petrochemical facilities. The two catalytic reformers are equipped with Udex extraction units. Udex is integral with one catalytic reformer, thus is referred to as a Rexformer. Petrochemical products include benzene-toluene-xylene fractions, polybutenes, paraxylene, and styrene produced via dehydrogenation of ethylbenzene. Ethylbenzene is isolated from a xylene fraction by super-fractionation.

Gas streams routinely analyzed by vapor phase chromatography include alkylation feedstock, styrene reactor overhead gas, separator overhead gas from catalytic reforming, poly plant feed, and miscellaneous residue and tail gas streams.

Cosden uses a six foot column packed with dioctyl phthalate, operating at 35 C to analyze saturated and unsaturated C_3, C_4 and C_5 hydrocarbons in alkylation feedstock. The same column is used to check the pressure of C_6 paraffins, naphthenes, and aromatics in separator overhead gas from the catalytic reformers. When analyzing reformer tail gases, nitrogen rather than the more standard helium can be used as the carrier gas because of the similar thermal conductivity of helium and hydrogen.

Analysis of styrene reactor overhead gas has proved valuable for control purposes. If the concentration of either methane or ethane increases markedly above a set limit, excessive cracking is indicated. Also, by watching the change in concentration of CO and CO_2 in this stream, optimum reactor conditions can be maintained.

Many liquid streams are routinely analyzed, too. Cosden has found, for example, that a chromatographer can be used to measure trace amounts of water in hydrocarbon streams. They plan to use this technique to evaluate dehydrator operations, and suggest that a process monitor might be used in some instances to reduce the size and cost of dehydrators.

Natural gasoline is processed in some quantity at Big Spring, with chromatography used to determine butane and pentane content. For this analysis, the heavy ends are simply back-flushed from the column after the light ends have passed through the thermal detector. Only a simple calibration is required for this analysis.

Study of aviation alkylate is now being considered at Cosden's labs, to see if it is possible to control the unit to produce a particular type of alkylate from mixed olefin feedstock which will result in the best performance number. A battery of chromatographers, operating at different temperatures, will be used to reduce analysis time.

Petrochemical operations are monitored successfully with a vapor phase chromatograph, too. For example, mixed xylenes containing about two percent C_9 aromatics are routinely analyzed, with an accuracy of ± ½ percent. Styrene and ethylbenzene containing very low concentrations of impurities are also tested periodically. In both cases, a column packed with fluorene and picric acid, operating at 90 C is used.

Other uses include "peak trapping" to isolate components for further analysis either by ultraviolet or infrared. Chadd and White also suggested further exploration into preparation of high purity samples to be used for calibration of mass spectrometers, infrared, ultraviolet, and other instruments. And, development of a capillary column chromatograph for micro analyses might prove helpful, they stated.

A possible future application mentioned was used in odor control. Chadd and White theorized that since odors are caused by particular compounds, a sample of gas could be collected to check for certain smells. It was pointed out that smog control studies are currently using this technique and that refineries could use it to insure a particular product odor, replacing the far less accurate human "sniff test."

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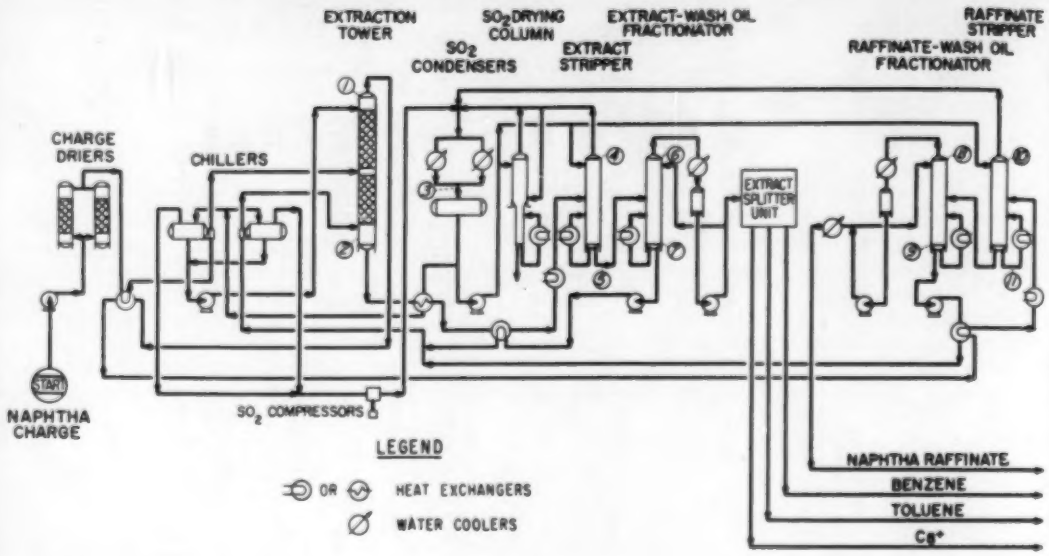

OPERATING CONDITIONS:

Point	°F	psig	Point	°F	psig	Point	°F	psig
1	−20	−9.2	4	115	100	8	225	8
2	−20	—	5	382	—	9	450	—
3	110	98	6	267	8	10	115	100
			7	450	—	11	390	—

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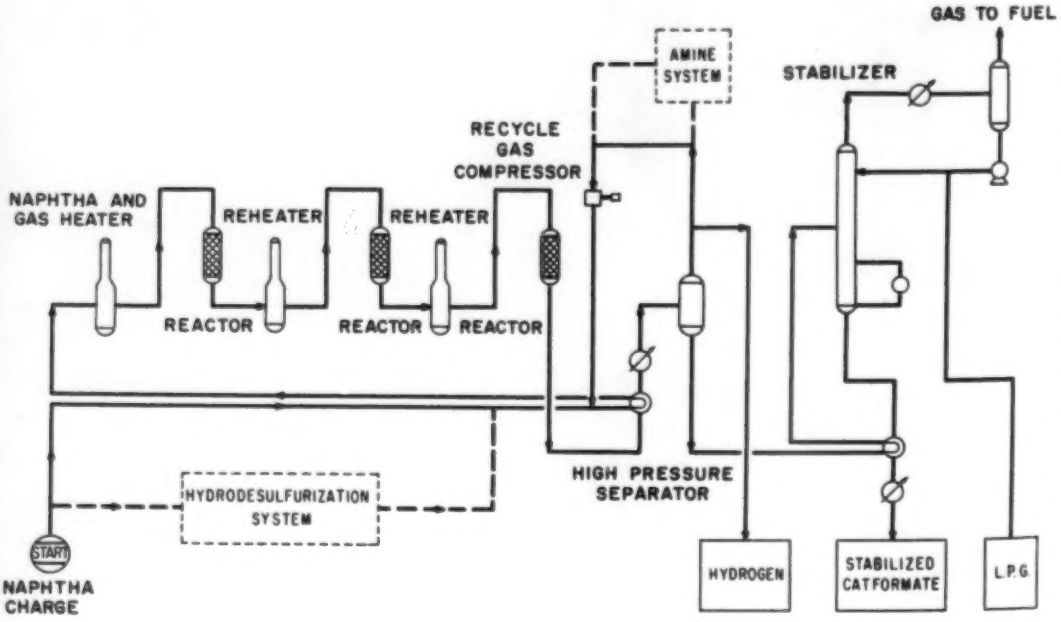
The Refining Engineers' Process Notebook



OPERATING CONDITIONS:

	°F	psig
Reactor Inlet	850-975	200-500

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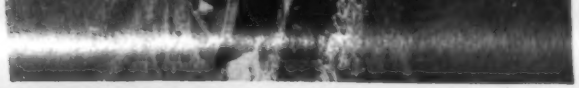

Shifting of the new and enlarged Matson Navigation Company's Hawaiian Pioneer from the ways to the water is accomplished through the use of a unique rail device

On a single platform, formed by the fully extended "jungle" of the hemispherical dome, makes the structure towering

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Baltimore Harbor
Los Angeles Harbor

SHIPBUI
Quincy, Mass.
Sparrows Point,
San

THE REFIN

Catforming

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DESCRIPTION: This catalytic reforming process is designed for upgrading straightrun, coker distillate, thermal, or catalytic gasolines. If there is a high percentage of cracked naphtha or high sulfur content in the feed, a combined Unifining-Catforming process is used.

Incoming feedstock is mixed with a recycle hydrogen stream, heated to 850-975 F at 200-500 psig and passed over the reforming catalyst, in three fixed beds.

Reactor effluent is cooled and the naphtha condensed and stabilized, then sent to storage intermediate to gasoline blending.

Catforming catalyst, developed by Atlantic Refining Company, is a platinum on silica-alumina material, characterized by very low yields of methane and ethane.

SERVICE FACTOR: 95 Percent

UTILITIES:

	Per B Feed
Steam @ 400 psig	43 lb
Power	120 kwh
Cooling Water	25 gal
Fuel	108 M Btu

CHEMICALS AND CATALYSTS:

Catalyst Inventory: 2-5 lb per BPD
Catalyst Consumption: 0.005-0.015 lb per B
Chemicals Consumption: nil

OPERATING MANPOWER: Varies with unit capacity, several "medium" sized units being operated by one operator per shift.

INVESTMENT: $150-250 per BPD

MAINTENANCE COSTS: About 2½ percent of investment annually.

TYPICAL CHARGE AND YIELD EXAMPLES

Charge Stock			
API Gravity	55.9	60.2	54.0
Sulfur, Wt. %	.075	.035	.08
F-1 Octane Clear	39.1	38.6	46.4
ASTM Dist. F.			
IBP	216	164	213
50	270	251	275
EP	351	354	354
Yields			
Weight Percent			
Hydrogen	0.9	0.8	1.1
Methane & Ethane	3.0	1.8	0.6
Propane	8.8	6.7	3.7
Volume Percent			
Butanes	19.1	17.0	12.4
C_5+	70.0	75.0	82.5
C_5+ Octanes			
F-1 Clear	95.6	88.2	89.3
F-1 with 3cc TEL/Gal.	102.00	99.0	98.6

Modified SO_2 Extraction for Aromatics Recovery

Licensed by: Stone & Webster Engineering Corporation

DESCRIPTION: The modified SO_2 Extraction Process may be used for recovery of pure or highly concentrated aromatics from catalytic reformates, selected naphthas or gas oils. Process conditions shown apply to catalytic reformate feed.

First dried and chilled, feed is contacted with cold liquid SO_2 in the top section of the extraction tower. A kerosine wash oil strips the extract in the lower section of the same tower.

Extraction tower overhead is fractionated to separate raffinate from the recycle SO_2 and wash oil streams. Bottoms from the extraction tower are distilled for SO_2 and wash oil recovery. The aromatics extract from the tower bottoms is further separated into benzene, toluene, and a C_8 aromatics stream.

SO_2 may serve as both extractant and refrigerant as shown, or refrigerant requirements may be supplied fully or in part by propane. SO_2 water content is kept low by fractionating a part of the recirculated stream.

TYPICAL AROMATICS PURITIES AND RECOVERIES:

	PURITY	RECOVERY
Feed	46 vol %	
Products		
Benzene	Nitration grade	98%
Toluene	Nitration grade	98%
C_8 aromatics	90+%	95-97%
Raffinate	0.5 vol %	

SERVICE FACTOR: 93 Percent

UTILITIES

	Per B Feed
Steam @ 150 psig	70 lb
Power	1.6 kwh
Cooling water	1,600 gal
Fuel*	580 XM Btu

*Includes that for gas engine driven compressors

CHEMICALS

	Per B Feed
Caustic	0.35 lb
SO_2	0.28 lb

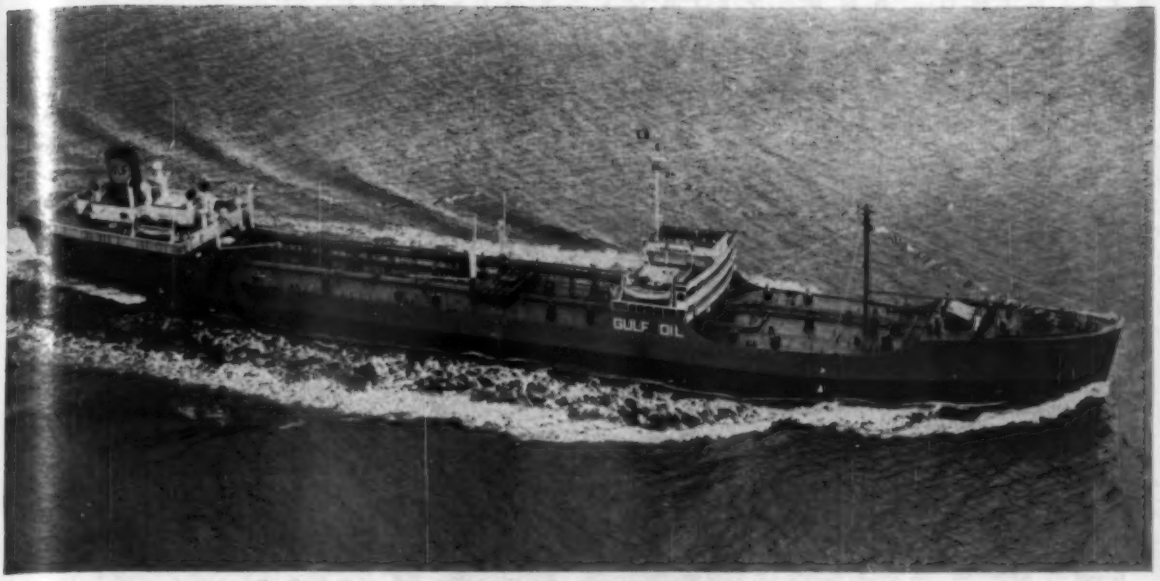
OPERATING PERSONNEL — Three men per shift

INVESTMENT (U.S. Gulf Coast, 1957)

Capacity, B/SD	$, Thousands
4,000	3,150
6,000	4,000
8,000	4,700

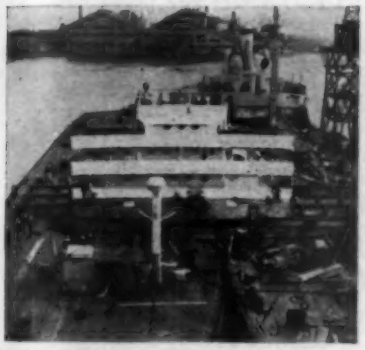
ANNUAL MAINTENANCE

Total for materials and labor 4% of investment.

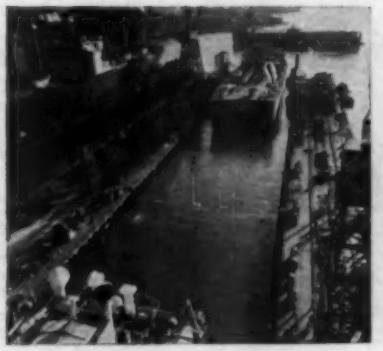


The *S.S. Gulfbeaver*, first "jumboized" T-2, was converted by Bethlehem's Baltimore Yard in 36 days. "Jumboized," she has an overall length of 572 ft, beam of 75 ft and capacity of 20,168 dwt.

BETHLEHEM'S BALTIMORE YARD COMPLETES FIRST JUMBO T-2



Shifting of the 160-ton midships house from the old to the new and enlarged midbody was accomplished in 16 minutes through the use of an ingenious roller-bearing rail device



The new midbody was floated into dry dock for welding to the original stern, part of which can be seen in the foreground. In the background is the original midbody with bow still attached.

Following joining of the new and enlarged midbody to the stern, this unit was floated into another dock for welding to the original bow section which had been detached from the old midbody.

On April 2, 1957, the 20,168-dwt *S.S. Gulfbeaver,* formerly the 16,500-dwt *Gulfmeadows,* successfully completed her sea trials and became the first "jumboized" T-2 to get into operation.

Only 36 days earlier she had entered Bethlehem's Baltimore Repair Yard for the history-making job. The new midbody section was constructed by Bethlehem's Sparrows Point Yard and towed to Baltimore. Here the Bethlehem repair yard, long a pioneer in complex conversions, tackled the "jumboizing" task and cleaned it up in five weeks.

With 48½ ft added to her length, 7 ft to her beam, approximately 3,500-dwt to her payload capacity and 12 to 15 years to her life, the *Gulfbeaver* is an example of Bethlehem's proven ability to handle all types of ship conversions and repairs with speed, economy and dependability.

SHIP REPAIR YARDS

Boston Harbor — New York Harbor
Baltimore Harbor — Beaumont, Texas
Los Angeles Harbor — San Francisco Harbor

SHIPBUILDING YARDS

Quincy, Mass. — Staten Island, N. Y.
Sparrows Point, Md. — Beaumont, Texas
San Francisco, Calif.

BETHLEHEM STEEL

Shipbuilding Division

GENERAL OFFICES: 25 BROADWAY, NEW YORK 4, N. Y.

On the Pacific Coast shipbuilding and ship repairing are performed by the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation

REFINING AND PETROCHEMICAL

PERSONALS

Charles Newton Kimberlin Jr., assistant director of the Esso Research Laboratories, Baton Rouge, Louisiana, has won the 1957 Southern Chemist Award of the American Chemical Society's Memphis section.

Harold A. Koechling, a member of the board of directors of Esso Standard Oil Company since 1944, has retired. Prior to his appointment as a director of Esso Standard in 1944, Koechling was assistant controller of Esso's parent company, Standard Oil Company (New Jersey). He served as controller of Esso Standard from 1944 until 1956.

Clifford Oman, process superintendent, has been named assistant plant manager for National Petro-Chemicals Corporation at Tuscola, Illinois. National Petro-Chemicals is a subsidiary of U. S. Industrial Chemicals Company, division of National Distillers and Chemical Corporation, and Panhandle Eastern Pipeline Company.

Byron J. Anderson has been named manager of the polyethylene plant which will be built at Houston, Texas, by National Petro-Chemicals. He was serving as assistant chief technologist at their Tuscola plant at the time of his appointment.

J. W. Ferguson, Houston, has been promoted to director of natural gasoline and gas operations for Continental Oil Company. Formerly director of Conoco's economics and statistics division, he will continue to make his headquarters at Houston and will succeed **C. L. Ritter,** who has transferred to Constock Liquid Methane Corporation, a Conoco affiliate.

Dr. Vladimir Haensel, director of refining research, Universal Oil Products Company, Des Plaines, Illinois, has been named winner of the 1957 Professional Progress Award in Chemical Engineering. it was announced by the American Institute of Chemical Engineers. The award, sponsored by the Celanese Corporation of America, and consisting of $1,000 and a certificate, was presented to Dr. Haensel during the 4-day annual meeting of AIChE in December by **Dr. J. Henry Rushton,** Institute president.

Dr. Vladimir Haensel

W. L. Banks

W. L. Banks has been named consulting technologist of the Western Petroleum Refiners Association. Formerly he was manager of the Tulsa offices for the petroleum catalyst division of Davison Chemical Company.

Robert R. Gumaer has been promoted to senior chemical engineer in the research and development department of American Oil Company. Gumaer was employed by Pan-Am Southern Corporation in November 1942. Following Pan-Am Southern's integration with American Oil, he transferred to Texas City and was assigned to the economics section of the research and development department in September 1956. Prior to his transfer he was technical assistant to the vice president in charge of manufacturing of Pan-Am Southern.

Benjamin H. Weil of the Esso Research and Engineering Company, Linden, New Jersey, has been elected 1958 chairman of the American Chemical Society's division of chemical literature. Weil, who is chief editor of his company's technical information division, succeeds **Dr. John H. Fletcher** of the American Cynamid Company, Stamford, Connecticut. **Hanna Friedenstein** of Godfrey L. Cabot, Inc., Boston, was chosen chairman-elect and **Virginia R. Valeri** of Arthur D. Little, Inc., Cambridge, Massachusetts, was renamed treasurer. **Dr. Harriet A. Geer** of the National Research Council, Washington, D. C., is the new division secretary.

E. D. Loughney and **D. L. Campbell,** both former vice presidents have been named to the newly-created positions of senior vice presidents of The British American Oil Company Limited. Loughney is also a director of several pipeline companies including Trans Mountain, Interprovincial, Trans-Canada, Trans-Northern, Westspur, Montreal, and Portland. Campbell is a director of Trans-Northern Pipe Line Company and B. A. -Shawinigan Limited.

Quoth Sir Galva-Knight:

"EXTRA PROTECTION PAYETH DIVIDENDS!"

. . . And hot-dip galvanizing by the Nowery J. Smith Company provides any iron or steel item with the extra protection from rust that only a tough armor-plating of zinc can give. Whether it's a bolt or a beam, hot dip galvanize it at the Nowery J. Smith Company in Houston, the Southwest's largest commercial galvanizing operation.

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Liquid Wrench works *fast* ... yet is absolutely safe for all metals and alloys.

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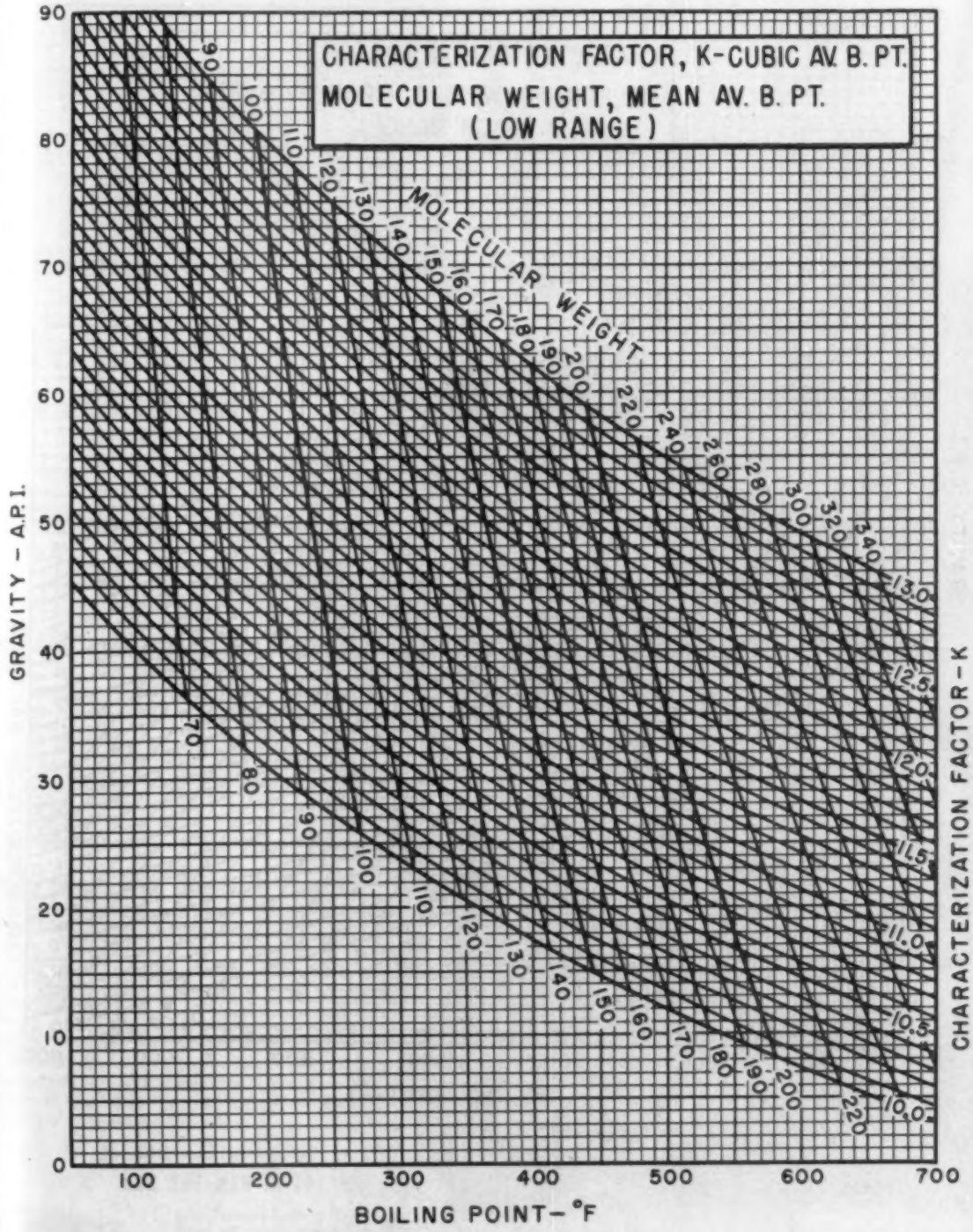
Charlotte, North Carolina

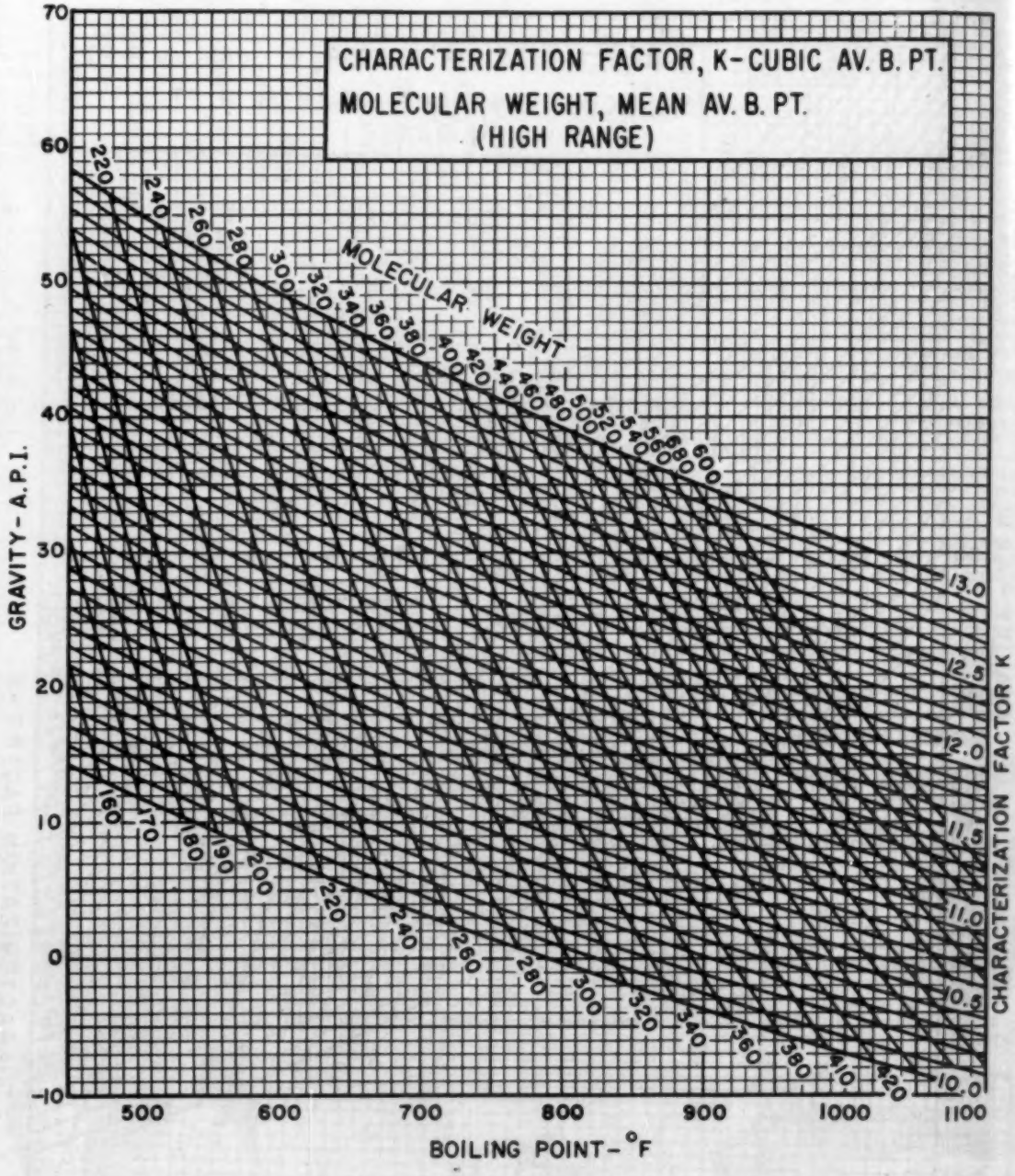
Vapor/Liquid Equilibrium Constants for Hydrocarbons

This month's Continuous Tables for determining characterization factor are a continuation of the series of charts on Vapor/Liquid Equilibrium Constants that started as a supplement to the December issue. This series will be concluded in February.

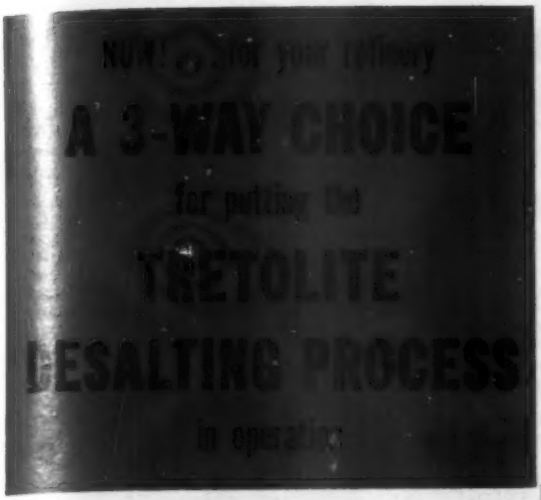


(Figure 2)

Vapor/Liquid Equilibrium Constants for Hydrocarbons



(Figure 3)



Tretolite desalting, the first all-chemical desalting process, is now available to you in a choice of plans, one of which is certain to fit into your operation and financial policies:

1 Standard Proposal

The Tretolite Company furnishes a list of the equipment required, instructions for installation and working drawings, designed to tie in with the flow stream in the customer's refinery. Data on the rate of Tretolite injection for optimum desalting results, operating instructions, temperatures, pressures and water requirements are also included. Tretolite Refinery Service Engineers check construction procedure to insure that installation is according to specifications; they also assist with start-up and make periodic visits after the unit is in regular operation.

2 Outright Purchase

The Tretolite Company ships the desalting plant equipment to the refinery. Erection is then carried on by refinery personnel or by an erector of the customer's choice. Inspections during construction, start-up assistance, and periodic inspections are provided by the Tretolite Refinery Service staff as in plan No. 1. When the desalting plant is ready to go on stream, Tretolite Refinery Service Engineers supervise an acceptance test run to meet the guarantee of minimum chemical requirements and salt removal efficiency as set forth in the contract.

3 Rental with Option to Purchase

The rental plan is similar in all general respects as to instructions, supervision and materials furnished in plans No. 1 and No. 2. After acceptance requirements have been fulfilled, the pre-determined annual rental fee is payable according to the payment option selected by the customer.

After the plant has been operated for three years on the rental basis, the customer has the option of purchasing the equipment for a pre-determined price. (This price is reduced after each year's rental.) After a unit has been used on a rental basis for seven years, the annual rental fee is reduced about 50%.

For additional information,

ASK THE MAN IN THE RED CAR

Your Tretolite Refinery Service Engineer will gladly give you complete information on the various ways of acquiring Tretolite Desalting equipment, as well as operating and performance data on plants currently in service.

advantages of the
TRETOLITE DESALTING SYSTEM

- *Proved Performer.*
  Used to purify 1½ million barrels every day.
- *95 to 100% Salt Removal.*
- *Average Chemical Cost of 1.3 mills per Desalted Barrel.*
- *Automatic Operation.*

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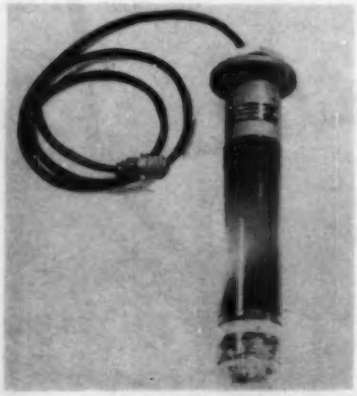
NEW Refining Equipment

• machinery • supplies • services

For more information on items described here in brief, use the handy reply card and circle the corresponding numbers

Density Measuring System. General Communication Company announces the design, development and production of its density measuring system, Model P-625. The P-625 is a practical industrial system for the measurement of the density of liquids during transit, storage, or throughout the complete cycle of a reaction. This automatic, continuously operating instrument indicates instantaneous changes and permanent recordings where so desired.



Comprised of a probe and power supply, the system is simple to install with all units constructed for ready access and easy maintenance. The P-625 is accurate to ±.001 gram; is not affected by pressures from 0 to 125 psi; will indicate liquid density change of .010 gram per cc in about 1 sec. The model has an indication range of .690 to 1.450 grams per cc. Accuracy is maintained through the temperature range of 0 to 100 C. *General Communication Company.*

Circle number (41) on reply card.

Gas Chromatography Analyzer. The new "Chromomax" analyzer has been announced by Leeds & Northrup Company. This instrument can analyze as many as 4 process streams containing natural gases, vapors, low boiling point liquids and hydrocarbons, with 8 such components in each stream. The Chromomax instrument assembly consists of an explosion-proof analyzer unit, a programming unit and a speedomax G recorder. *Leeds & Northrup Company.*

Circle number (42) on reply card.

IR-5 Spectrophotometer. A simplified low-cost infrared instrument, the double-beam automatic recording IR-5 Spectrophotometer, was introduced by Beckman Instruments. The instrument has only 5 controls, records linearly in transmittance and wavelength and will scan the entire 2-16 micron range in 16 min. An automatic flat-bed recorder permits use of preprinted, file-size charts and the spectrum is visible at all times. Notations may be made right on the chart while a scan is in progress. When the wavelength drive motor is stopped, manual scans can be simply made. *Beckman/Scientific Instruments Division.*

Circle number (43) on reply card.

Freeze Protector. Velan Steam Specialties announces the addition of a safety device to protect condensate lines in cold weather, where temporary pressure failure can mean freeze ups, broken lines and lost production time. The Velan Freeze Protector consists of a specially designed bi-metal element in a forged steel body with all stainless steel trim and stellited valve seat. It is installed in the low points of return mains or before risers and the normal temperature of the condensate keeps the valve closed. In the event of boiler pressure failure or line blockage, the resulting temperature drop will cause the element to open the valve to atmosphere at a predetermined temperature of 90 to 120 F. The ½-in. orifice has sufficient capacity to drain the lines quickly before freezing can take place. *Velan Steam Specialties, Inc.*

Circle number (44) on reply card.

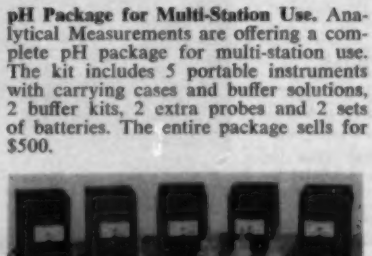
All Nylon Filter. This specially molded Danco all-nylon filter features 1-piece mold with mesh and structural frame injection-welded together in a permanent bond. The filter is easily cleaned and won't rust or corrode. It is claimed to be especially advantageous in filtering gasoline, lube, diesel, and hydraulic oils, as well as many other filtering applications. *The Danielson Manufacturing Company.*

Circle number (45) on reply card.

Telemeter Receiver. A multiple-printing strip-chart Metameter telemeter receiver has been announced by Bristol. The telemeter receiver will print out up to 16 separate records from as many telemetering transmission centers. Using a multiple-switching arrangement, the receiver can monitor successfully a large number of values from any distance necessary. The variables need not be all of 1 kind, but could be a combination of pressure, flow, temperature, liquid level, etc. *The Bristol Company.*

Circle number (46) on reply card.

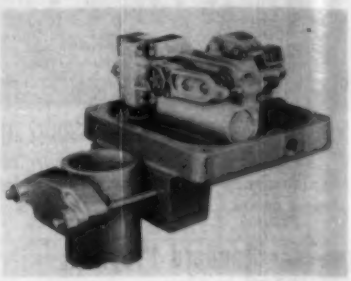
pH Package for Multi-Station Use. Analytical Measurements are offering a complete pH package for multi-station use. The kit includes 5 portable instruments with carrying cases and buffer solutions, 2 buffer kits, 2 extra probes and 2 sets of batteries. The entire package sells for $500.



Many inter-department trips are eliminated since each department can have its own meter for instant checking. The growing need for multi-station pH control has prompted the sale of these meters in a package plan. *Analytical Measurements, Inc.*

Circle number (47) on reply card.

Temperature and Pressure Transmitter. A new, compactly designed temperature and pressure transmitter has been announced by Mason-Neilan. Designated Series 4600 for temperature and Series 4700 for pressure, these transmitters are pneumatic force-balance devices employing gas filled thermal systems for temperature measurement and bellows elements for pressure.



One outstanding feature is said to be their Balanced Beam design which permits mounting of the transmitter in any position without positional error. Unit subassembly construction is used throughout, permitting removal of sub-assemblies without disturbing beam assembly. Thermal systems and pressure elements are readily removed for change of range span. *Mason-Neilan, div. of Worthington Corporation.*

Circle number (48) on reply card.

Heavy Duty Sump and Process Pumps. A new and complete line of heavy duty vertical centrifugal pumps for sump and process service has been introduced by Goulds Pumps. These single and duplex units, both wet and dry type, have capacities to 1080 gpm with heads to 290 ft for pit depths up to 20 ft. Basic design of Goulds Fig. 3171-2-3-4 sump pumps provides users with custom built pumps through novel usage of standardized parts. Pump assembly, including the cover plate, is a complete unit. Both wet pit and dry pit type units are furnished in standard lengths with 6-ft increments for all pit depths from 2 to 20 ft. With single pump, submerged or wet pit type units, the pump is placed directly into the sump which contains the liquid to be pumped. Liquid level controls can be furnished to start and stop the pump automatically. With duplex pumps, submerged or wet pit type units, 2 pumps are mounted on the pit cover. *Goulds Pumps, Inc.*

Circle number (49) on reply card.

Automatic Stream Selector. The availability of a Beckman Automatic Stream Selector for use with the Beckman Model 120 and Model 220 industrial gas chromatographs as well as hygrometers, infrared, and other type stream analyzers is announced by Beckman Instruments. When used in conjunction with Beckman industrial chromatographs, the stream selector makes possible the consecutive monitoring of 2 or more identical streams. *Beckman Instruments, Inc., Process Instruments Division.*

Circle number (50) on reply card.

Magnetic Flowmeter. Fischer & Porter's new magnetic flowmeter accurately measures the flow rate of difficult liquids such as slurries and slurries without adverse effects to the meter. Major features are: Manual adjustment for setting any desired flow rate at full scale (the 1-in. meter can be set to handle from 3 to 40 gpm at full scale; the ½-in. meter as low as one gpm); unrestricted flow; readings unaffected by velocity profile, density, or viscosity; voltage changes between 90 and 125 V and frequency changes between 55 and 65 cycles have no effect on readings; special piping for long metering runs is not required; flow can be measured in either direction. *Fischer & Porter.*

Circle number (51) on reply card.

Fully-Transistorized Computer-Data Processing System. This advanced electronic system will generate data to insure peak efficiency in the operation of the complex ethylene process. Beyond straight recording functions, the system will provide plant operators with computed real-time data for optimum process control. The unit can perform addition, subtraction, multiplication, division and square root. Combining these operations for solution of high order equations, it will automatically compensate gas flow rates for temperature and pressure and perform other computations to yield accurate material balances, throughput volume and related operating data. In place of vacuum tubes, the unit employs semiconductor devices and magnetic amplifiers throughout to insure years of continuous operation. *Beckman Instruments, Inc., Systems Division.*

Circle number (52) on reply card.

Climate-Lab. This instrument can duplicate and accurately sustain almost any global climatic condition. The Climate-Lab has a 9.6 cu ft capacity test chamber which is highly insulated. This instrument conditions the air before it enters the test chamber. Controls on the testing equipment are accurate within plus or minus 1 percent relative humidity, and plus or minus 1 F. A constant control system which records time, temperature and humidity is included. The Climate-Lab can recreate any climatic condition up to 99 percent relative humidity, and up to 160 F. *Allegheny Ludlum Steel Corporation.*

Circle number (53) on reply card.

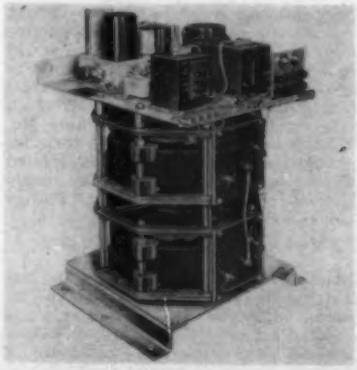
Miniature Pressure Pickup. Continued developments toward transducer miniaturization have resulted in an extremely small pressure pickup which does not sacrifice performance characteristics. Known as the Type 4-320 miniature pressure pickup, the unit is only ½ in. in diameter and less than ¼ in. thick. Differential and gage pressure ranges from ±7.5 to ±50 psiD and 25 or 50 psig, are available for operation at line pressures up to 300 psi. Offered concurrently with the 4-320 is the Type 4-321, which extends the application capabilities of the 4-320 by providing it with a stainless-steel casing, 1-in. square and ⅜-in. thick. *Consolidated Electrodynamics Corporation.*

Circle number (54) on reply card.

Flue Gas O_2 Analyzer Recorder. This complete, self-contained O_2 test unit is an effective tool for helping to improve combustion efficiency. The equipment operates in ambient temperatures between 32 and 120 F, and from any standard non-regulated 115 V 60 cycle power source. An electrically driven vacuum pump and a full-flow sample filter, mounted on the rear of the rack, provide a sample volume of ½ cfm at a velocity of 6 fps when using a ½-in. ID plastic tubing line to the probe. *Leeds & Northrup Company.*

Circle number (55) on reply card.

Stabiline Automatic Voltage Regulator. Features of the Stabiline automatic voltage regulator type EM10018 include the extension of life and reliability of high-priced, complex vacuum tubes in sensitive electronic equipment. The design is based on a combination of adjustable voltage control and automatic voltage regulation functions. Operation is fully automatic when used with external contactors and on-off controls. When the equipment is energized, the voltage to the tubes is run-up gradually to minimize the surge strain on the filaments that appreciably shortens tube life.



The voltage run-up takes 5 to 14 sec depending upon the output voltage setting and whether the Stabiline has been in operation immediately prior to run-up. Input: 208 V ± 10 percent, single phase, 57-63 cps. Output: 208 V nominal, 0-163 V unregulated, 163-208 V adjustable regulated, 45 amps at 40 C ambient; accuracy ±1.0 percent for rated line and load changes. *The Superior Electric Company.*

Circle number (56) on reply card.

Asbestos Building Board. Asbestolux, the asbestos building board introduced by North American Asbestos has been tested and found to be incombustible. The material was tested and received the following ratings. Flame spread — 0; fuel contributed—negligible; smoke developed—0. *North American Asbestos Corporation.*

Circle number (57) on reply card.

New Type Floor Patch. A unique floor patching material for use in all types of industrial plants has been placed on the market under the name of Chemi-Patch. The only normal preparation required to apply Chemi-Patch is to wire brush where necessary to remove loose particles from the surface. No deep chipping out or cutting around the edge of the area to be patched is required. Chemi-Patch comes completely packaged as an all-in-one unit in a 2½ gal sealed container, which contains the aggregate in a plastic bag and 3 cans which include the catalyst, a binder and a smoothing agent. Chemi-Patch forms a durable non-slip surface, three times the compressive strength of concrete. *The Garland Company.*

Circle number (58) on reply card.

New Expansion Joint. For those installations where settlement, vibration or thermal expansion is a factor there is a new expansion joint available for conveying air, gas, volatiles, and liquids. These expansion joints can absorb longitudinal and lateral movement in 1 cycle. Opposite ends of the expansion joint can move laterally in opposite directions to complete an expansion cycle. In making lateral movements the tubing will freely extend itself to permit the flanged end to remain in the same parallel line with the original installation. Penflex expansion joints are available in sizes ranging from 4 in. ID to 26 in. ID with rigid or floating patented Titepak flanges and the joints packed with asbestos or special packing according to specifications. Bursting pressures on these expansion joints range up to 1200 psi. *Pennsylvania Flexible Metallic Tubing Company.*

Circle number (59) on reply card.

Aluminum Valves. Gate valves of aluminum alloy are being offered for general application by Darling Valve & Manufacturing. The Darling aluminum alloy gate valves currently available range from ½ through 24 in. sizes and include types for every requirement where aluminum piping systems are now being used or planned. These valves incorporate the principle of fully revolving double disc parallel seat gate valve operation. Very sizeable savings are possible, particularly in large valves, compared with valves of other metals suitable for the handling of problem gases and fluids. *Darling Valve & Manufacturing Co.*

Circle number (60) on reply card.

Continuous Integrator. A continuous integrator that over a period of time totalizes rapidly changing process variables convertible into an electrical signal has been developed. Its principal use is in chemical and refining operations to measure total power consumer in the electrodeposition of metals and for chromatography in measuring the relative quantity of component parts in gas mixtures. The records of variables such as temperature, flow, pressure, kilowatts and Btu's can be integrated on any strip or circular chart recorder whose transmitting slidewire has a linear output and a resistance between 20 and 250 ohms.

The instrument, which can be added to a recorder regardless of control features, reads out the integration on a 6-digit counter and on the chart record by means of a dual (tens and units) pipping pen. Full-scale count rate is continuously adjustable up to a maximum of 500 per minute when a pipping pen is used or 1000 per minute otherwise. *Brown Instruments, div. of Minneapolis-Honeywell Regulator Co.*

Circle number (61) on reply card.

Low-Cost Data Processing System. A new low-cost data processing system for quick and easy processing and interpretation of seismic data was introduced. The "VIP" (Variable Intensity Plotter) offers central processing office advantages while preserving portability. Components of the system consist of a visual display unit measuring 31 in. by 31 in. by 32 in. and weighing 5 lbs and a computing unit measuring 31 in. by 13½ in. by 32 in. and weighing 85 lbs. The 2 units fit together. The system operates on 115 V 60 cycle a-c power and requires about 2 kw. *Texas Instruments Incorporated.*

Circle number (62) on reply card.

NEW Literature

For more information on items described here in brief, use the handy reply card and circle the corresponding numbers

Heavy-Duty Rotary Pumps. Bulletin No. 2064-B1 published by Worthington describes their line of heavy-duty rotary pumps. A dependable unit for pressures to 500 psi, and capacities to 25 gpm, the Type GAR is efficient and economical. Simplicity of construction incorporating herringbone gears and roller bearings, allows long, trouble-free service with minimum maintenance. *Worthington Corporation.*

Circle number (61) on reply card.

Analog-to-Digital Conversion. A reprint of an article entitled "Analog-to-Digital Conversion" is available from the Systems Division of Beckman Instruments. The various types of analog to digital converters are discussed and particular emphasis is placed on the voltage sweep analog to digital converter. Examples are given of the operation of the converter and how it logically arrives at the final digital value of the original analog inputs. *Systems Division, Beckman Instruments, Inc.*

Circle number (62) on reply card.

Treating Closed Engine and Compressor Cooling Water Systems. "Directions for Treating Closed Engine and Compressor Cooling Water Systems — Mobile and Stationary Units" is the title of a technical service bulletin issued by D. W. Haering and Co. Listed are factors which influence corrosion of engine blocks, cylinder liner failure due to pitting, and impairment of cooling because of accumulations of corrosion products. Proper inhibition of corrosion is required to control these factors and the characteristics essential to a good inhibitor are discussed. *D. W. Haering & Co., Inc.*

Circle number (63) on reply card.

New Solvay Booklet. An up-to-date review and bibliography of the application of hydrogen peroxide for epoxidation and hydroxylation is being offered by the Solvay Process Division. This booklet contains information on the various methods for epoxidation and hydroxylation of olefins with Solvay hydrogen peroxide, and a review of the many present and potential uses of the resulting products. *Solvay Process Division, Allied Chemical & Dye Corporation.*

Circle number (64) on reply card.

Oxycat Systems. Oxycat catalytic oxidation systems for industrial air-pollution control and heat recovery are described in a new 8-page bulletin. A new Oxycat package unit tailored for simple, fast installation in a large number of standard applications is described. Text, photos and diagrams illustrate the various Oxycat systems available, and explain how various construction and design features contribute to Oxycat efficiency and long life. Some Oxycat installations are reported still functioning at initial efficiency after more than 30,000 hours continuous operation, without servicing or maintenance of any kind. *Oxy-Catalyst, Inc.*

Circle number (65) on reply card.

Fractional Horsepower Geared Motors. Merkle-Korff Gear Company announces the release of a new bulletin illustrating and describing a standard stock fractional gear reducer motor, Model SG-15. In introducing a standard version of the Model SG-15 in a series of 16 output speeds ranging from 1 rpm at 15-in. lb full load torque to 300 rpm at 1.2-in. lb full load torque, the intention is to serve the off-the-shelf needs of hard pressed experimental and design engineers. *Merkle-Korff Gear Co.*

Circle number (66) on reply card.

Tests Prove 1715-Type Non-Slip Coatings. Such coatings prevent stacked goods from skidding and toppling during the movement, vibration, and handling they experience at production centers, packaging lines and warehouses, as well as during shipment. Field testing and major installations during the past year have proved the economy and effectiveness of container spraying to reduce product damage (and eliminate much taping, strapping or gluing of loads) wherever unitized stacks are handled by lift truck. With respect to toxicity the Horowitz report states, "Chemical analysis of the materials which make up Paisley Non-Slip Coating No. 1715, shows that it contains no toxic ingredients, and therefore any dust created by spraying it can be classified as merely a 'non-specific' or 'nuisance' dust." *Paisley Products, Inc.*

Circle number (67) on reply card.

Titanium Tubing. "Present Status and Future Potential for Titanium Tubing" by Thomas M. Krebs has been reprinted and is available from The Babcock & Wilcox Company. The outstanding resistance of titanium to many chemicals such as chlorides, indicates a large future use in the chemical and process industries as explained in Bulletin No. TR-550. *The Babcock & Wilcox Company.*

Circle number (68) on reply card.

Model 77 Flow Colorimeter. Beckman announces the availability of a new brochure on the Model 77 flow colorimeter. Bulletin 4000 gives descriptions and specifications for the standard Beckman flow colorimeter and for the new, improved ratio recording flow colorimeter. The instruments described continuously measure color intensity, turbidity, or chemical concentration in a wide variety of process streams. *Beckman/Process Instruments Division.*

Circle number (69) on reply card.

Refractories. Refractories for petroleum processing needs are the subject of a new 4-page bulletin published by Harbison-Walker. Included are data on 8 types of castable refractories, for service to 3000 F; fireclay, super-duty and high-alumina refractory brick; insulating refractories; a series of 7 bonding mortars and clays; tower packings; and acid-proof brick and tile. *Harbison-Walker Refractories Company.*

Circle number (70) on reply card.

Butadiene 4-Carbon Building Block. Texas-U. S. Chemical Co. has published a 52-page technical manual on butadiene which is believed to be the most comprehensive manual yet written on this chemical which is a major raw material for synthetic rubber. The manual contains specifications, physical and chemical properties, covers 150 chemical reactions, extensive indices on fields of end uses, reactants and reaction products and information on samples for experimentation. Its bibliography contains more than 300 references. Butadiene is a 4-carbon building block that until recently was used almost exclusively for the manufacture of synthetic rubber. Expanded production has now freed sufficient quantities of the chemical for other applications. *Texas-U. S. Chemical Company.*

Circle number (71) on reply card.

"Physical Properties" Booklet. This 28-page booklet is a guide to Carbide's products and services. Physical property data is presented on more than 350 organic chemicals. An alphabetical index is included for the convenience of the user.

Fifty new chemicals introduced by Carbide since the previous edition are featured. Viscosity index improver D and Crag Sevin experimental herbicide are 2 of the products described in the section on chemicals for special applications. For easy reference, other chemicals are arranged by related chemical groups with condensed application data. *Union Carbide Chemicals Company.*

Circle number (72) on reply card.

Gas Chromatographs. Three new sheets on gas chromatographs and accessories describe: The low cost, low temperature Beckman GC-1, for routine laboratory separation and analysis of gases and liquids boiling up to 80 C; the versatile, high temperature Beckman GC-2, for thousands of routine laboratory analyses of gases of liquids boiling up to 350 C; and the complete line of sampling accessories and column information that extend the range of applications of both instruments. *Beckman/Scientific Instruments Division.*

Circle number (73) on reply card.

Selas Dehydrators. Bulletin SC-1013 describes Selas dehydrators, designed and built to meet specific needs for effective and economical removal of moisture from most gases. Moisture removal and discharge from the system is continuous, with no flow interruption or interference. Gas inlet pressures may range from a few pounds gage to 150 psig for standard design with up to 3500 or more psig for special applications. Outlet dewpoint (moisture level) is maintained safely below the specified level, which can run to —100 F. *Selas Corporation of America.*

Circle number (74) on reply card.

Forged Steel Unions. Clayton Mark & Company has published a new brochure entitled "What Makes a Good Union?" Four fundamental qualities of a good union are described as pressure tightness, ease of installation, interchangeability, and ability to withstand repeated makes and breaks. Among other features which are highlighted in the brochure are: standardized design on American Association of Railroads specifications; hardness differential between seats to prevent galling and damage, and to provide for extremely tight seating; hot forged parts for heavy duty strength; and octagon wrench flats on both ends and nut. *Clayton Mark & Company.*

Circle number (75) on reply card.

Proposed or Planned Pipelines

The following tables list the company, mileage, pipe size, and location of proposed pipeline projects — crude, products, and natural gas — reported to *The Pipeline Engineer*. Company addresses are given when known.

CRUDE LINES

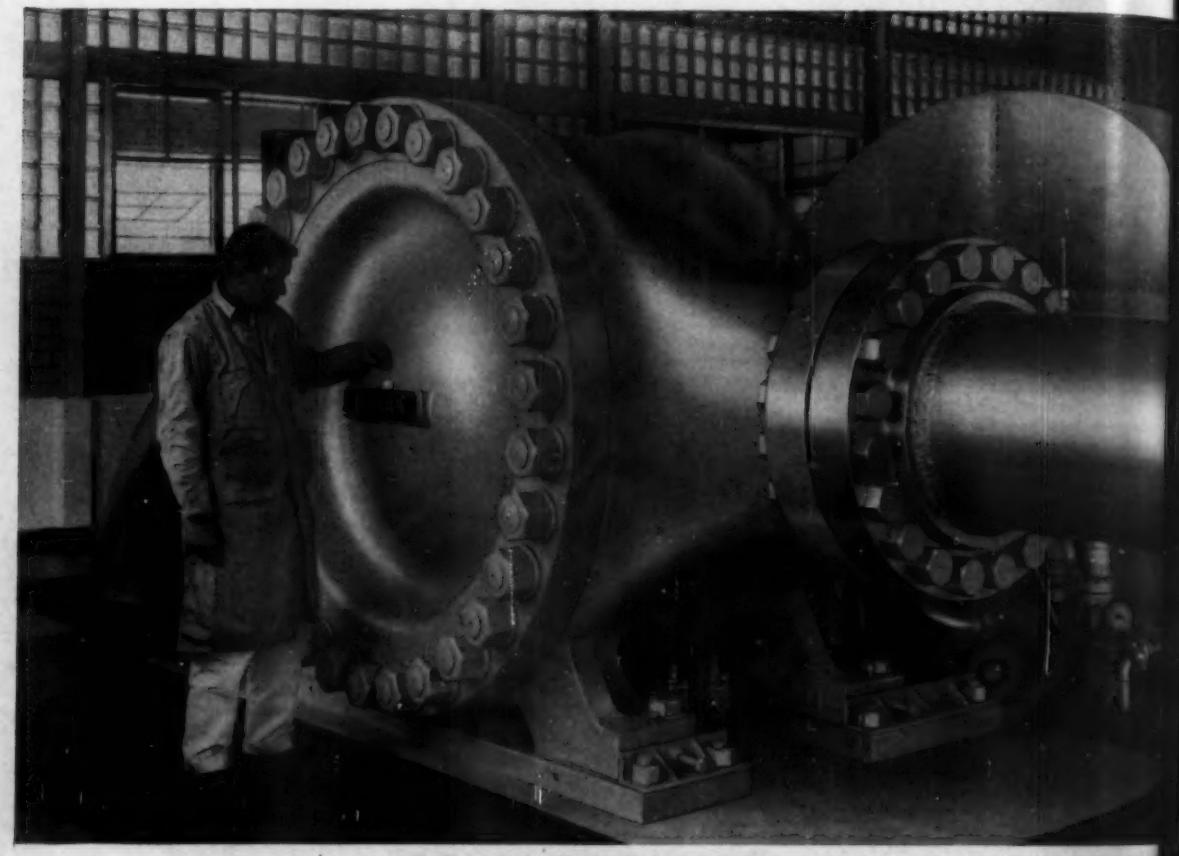
Name of Company	Miles	Size	Location
Act Oils Toronto, Ontario, Canada	350		Line from Peace River area in British Columbia, thru Pine Pass to Prince George, westward to Bella Coola terminus on Pacific Coast
Alborz Oil Company	1000	38	Qum, Iran, to Alexandretta, Turkey
Argentine Government (YPF) Buenos Aires, Argentina	640	12	Campo Duran fields to Rosario
Atlantic-Cities-Service-Continental-Gulf-Phillips-Texas-Sinclair	Approx. 385	26	Midland, Texas, area to Houston
Bituminous Oil Pipeline, Ltd. Calgary, Alberta, Canada	250	—	McMurray to Edmonton, Canada
Bolivian Government (YPFB) La Paz, Bolivia	215	8, 10	Interior of Bolivia to Arica, Chile
Cape Pipe Line Company Philadelphia, Pennsylvania	200		Large diameter from Delaware Bay to Greater Philadelphia area refineries
Creole Petroleum Corp. Caracas, Venezuela	86	30	Tamblador field to Caripito, Venezuela
Great Northern Railway Co. St. Paul, Minnesota	800		Williston Basin to St. Paul-Duluth-Superior, Wisconsin-Minnesota area
Humble Pipe Line Co. Houston, Texas	90	16	Hawley to Comyn, Texas
Iraq Petroleum Co. London, England	Approx. 600		Kirkuk field to Iskenderun, Turkey
Musgrove Petroleum Co. Wichita, Kansas	180		Hugoton field, Kansas, to Raymond, Kansas
North-West Oil Pipelines Company	210		Wilhelmshaven, on the North Sea, to industrial Ruhr area of West Germany
Offshore Gathering Company Houston, Texas	364	20	Gulf of Mexico from Sabine Pass to Mississippi River
Oil Field Pipe Line, Inc. and Panhandle Eastern Pipe Line Co. Kansas City, Missouri	200	8, 12	Elkhart to Ellinwood, Kansas
Royal Dutch Shell Group and Others The Hague, Netherlands	870	30	Marseille, France, to Rotterdam, Holland, and Antwerp, Belgium
Royal Pipe Lines, Ltd. Regina, Saskatchewan, Canada	288	Var.	Cantuar area fields to Glenavon
Shell Pipe Line Corporation Houston, Texas	100		Southwest Pass Terminal to Norco, La., Refinery
Sinclair Pipe Line Company Independence, Kansas	150	20	Teague to Houston, Texas
Southern Kansas Pipe Line Company	310	6, 10	10,000 bbl per day line from Greenwood pool, near Colorado line, thru Liberal to Arkansas City, Kansas
Trans-Border Line Company	110		Skagway, Alaska, to Whitehorse, Yukon Territory
17 American, English, French and Dutch companies	1500	38–40	Middle East producing areas to Mediterranean Coast in Turkey

PRODUCT LINES

Name of Company	Miles	Size	Location
American Pipe Line Co. New York, New York	1910	8–26	Beaumont, Texas to Newark, New Jersey
Buckeye Pipe Line Company New York, New York	70	8	Wayne to Durand, Michigan, common carrier
Everglades Pipe Line Company Everglades, Florida	60	10	Pt. Everglades to Miami, Florida
Hydrocarbons Pipelines, Ltd. Winnipeg, Manitoba, Canada	800	6–8	Edmonton, Alberta, to Fort William, Ontario
Laurel Pipe Line Company Pittsburgh, Pennsylvania	350	14–24	Philadelphia to Pittsburgh to Cleveland
Mene Grande Oil Co. Caracas, Venezuela	60	6	Anaco to Puerto La Cruz, Venezuela
Northwest Pipeline Corporation Salt Lake City, Utah	350	8–10	Four Corners to Salt Lake City, Utah
Ohio Oil Company Findlay, Ohio	250	12	Hartford, Illinois to Griffith, Indiana
Service-Continental-Sinclair-Phillips	550		Salt Lake City, Utah to Spokane, Washington
Underground Storage and Exploration, Inc.	393	6, 8, 12	Moundsville, West Virginia, to Newark, New Jersey, with laterals to Mauch Chunk, Marcus Hook, and Philadelphia
Union Oil Company of California Los Angeles, California	815		Shale oil plant, Rifle, Colorado to Los Angeles area
Winnipeg & Central Gas Company Winnipeg, Manitoba, Canada	210	6	U.S. Canadian border to Winnipeg

Only **CLARK** pipeline compressors
give you

EXPAND



Clark Pipeline Compressors are available in five flange sizes: 12x12, 16x16, 20x20, 24x24, 30x30

Here's What Clark Design Gives You

OVER-HUNG CANTILEVER IMPELLER—Only one shaft seal required.

OIL FILM TYPE SEAL—Completely dependable; field-proved; no moving parts.

INLINE SUCTION & DISCHARGE FLANGES—Simple to install; no additional piping; minimum floor space.

EASILY MODIFIED—Extensive changes in pressure-volume characteristics quickly handled by simple internal modification.

RUGGED CASES—Resist stress from pipe expansion. Extra heavy, fully machined studs on bolt circle.

QUIET—Minimum operating noise; easy on operators.

HIGH OR LOW RATIOS—To match pipeline requirements.

FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

ABILITY

They're the boosters with a built-in future

Clark centrifugal pipeline compressors, designed specifically to meet gas transmission requirements, are built to meet the future.

Now extensive changes in operating conditions can be handled within the same case at minimum cost and without sacrificing efficiency. Clark design permits replacement of the volute, as well as guide vanes and impeller, with components having completely different characteristics.

Key to this versatility is the design of the volute as an insert, not as an integral part of the case. Changes are made quickly—just remove the case cover, pull the insert, install a new one. The unit remains perfectly matched, and no piping modification is required.

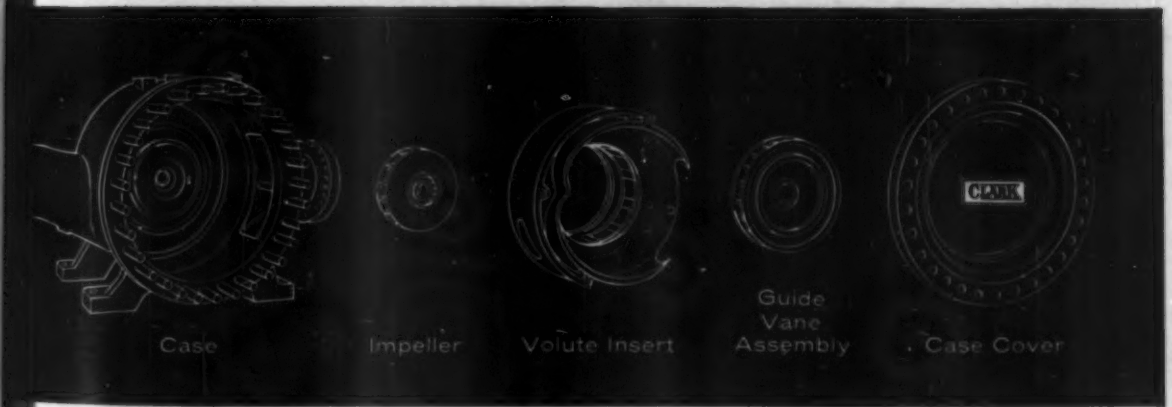
This versatility is supported by other special Clark features. Extra heavy and rugged cases withstand stress from pipe expansion without distortion. A single oil film type seal provides positive, gas-tight sealing during operation and at shutdown.

Many of these units are operating on the nation's gas transmission pipelines, driven by gas turbines, steam turbines or electric motors. They are supported by Clark's encyclopedia of experience. Your nearest Clark office will gladly give you all the facts and figures.

CLARK BROS. CO. • OLEAN, N. Y. *One of the Dresser Industries*
Sales and Service Outlets in Principal Cities Throughout the World

CLARK

Centrifugal Pipeline Compressors



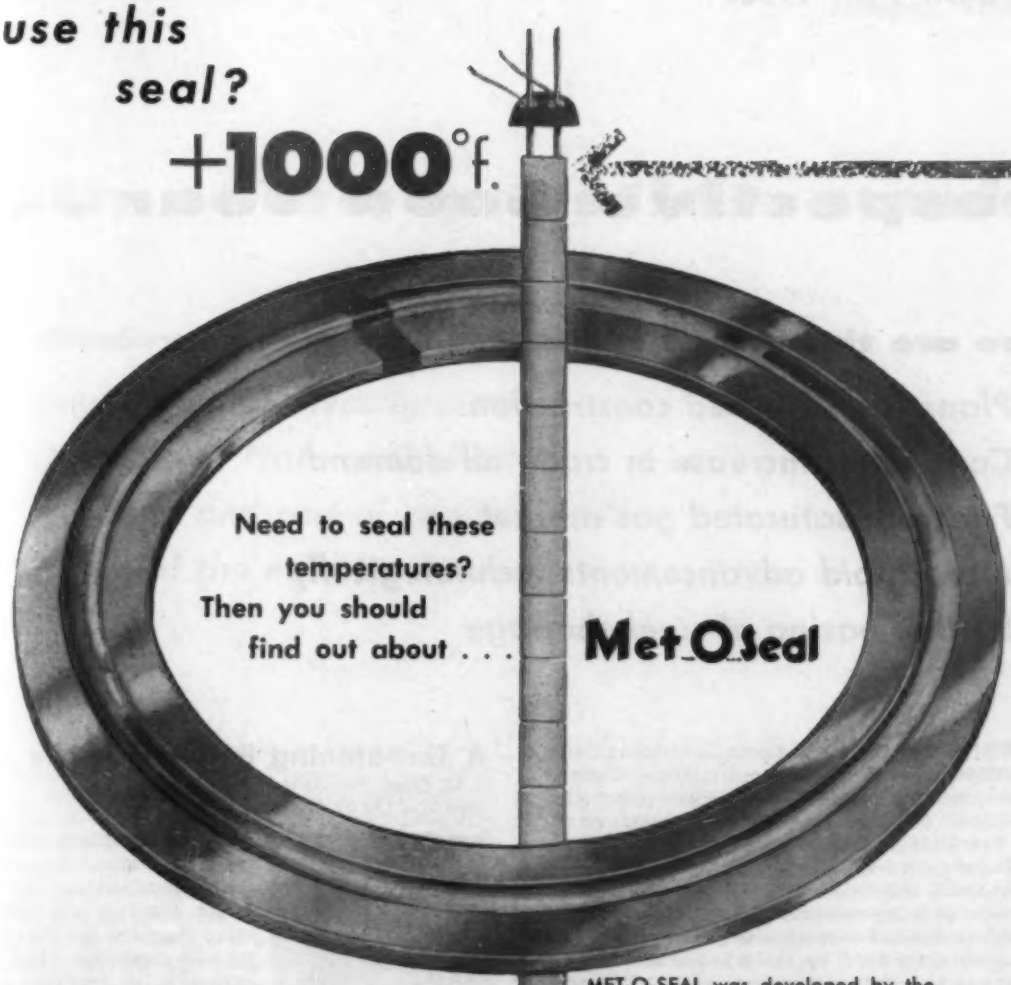
Complete internal assembly is easily interchanged to meet future conditions.

GAS LINES

Name of Company	Miles	Size	Location
Alberta Gas Trunkline Company, Ltd. Calgary, Alberta, Canada	449	6–34	Extensions to connect various fields
Andes Pipeline Corporation	500	12	Villamontes, Bolivia to Antofagasta, Chili
Argentine Government (YPF) Buenos Aires, Argentina	815		Campo Duran fields to Buenos Aires
Arkansas Louisiana Gas Company Shreveport, Louisiana	300		Main and gathering lines Louisiana-Texas Gulf Coast
Cities Service Gas Company Oklahoma City, Oklahoma	117	12–30	Replacements in Kansas
Coastal Transmission Corporation	574	22–26	McAllen, Texas to Baton Rouge, Louisiana
Dallas, Texas	414	Var.	Gathering lines in Rio Grande Valley, Texas
Colorado Interstate Gas Company Colorado Springs, Colorado	917	4–34	New lines, loops, replacements in Texas, Colorado, Nebraska, New Mexico, Kansas, Oklahoma
Cuban Gas Transmission Company (Edwin Pauley) Los Angeles, California	1000		Mexico to Florida via Cuba
Eastern Shore Natural Gas Company Salisbury, Maryland	124	6, 8	Transmission line and facilities in Delaware and Maryland
Edison Securities Company Los Angeles, California	130		San Joaquin Valley to Los Angeles
El Paso Natural Gas Company El Paso, Texas	599	6–30	New lines and loops, New Mexico and Arizona
Houston Texas Gas & Oil Company	942.6	12–30	Baton Rouge, Louisiana to Miami, Florida
Houston, Texas	682		Laterals to serve Florida distributors and industrial users
Michigan Wisconsin Pipe Line Company Detroit, Michigan	638	4–24	Laterals and loops in Wisconsin, Michigan, Missouri, Illinois, Indiana
Midwestern Gas Transmission Company Houston, Texas	2067	3–24	Main line from U.S. Canadian border near Emerson, Manitoba—Noyes, Minnesota, to Portland, Tennessee Laterals off main line to serve communities in Minnesota, North Dakota, and Wisconsin
Missouri Transportation Corp.	280	16	Delaware County, Okla., to St. Louis, Mo.
Mooki Chemical & Gas Corp. Tulsa, Okla.	169	16	Pottawatomie County to Delaware County, Okla.
Natural Gas Pipeline Company of America	416	36	Loop from Beatrice, Nebraska to Joliet, Illinois
Chicago, Illinois	337	30	Loop from Fritch, Texas to Beatrice, Nebraska
Niagara Mohawk Power Corp. Syracuse, New York	196	2–16	Central, eastern, and northern New York
North Carolina Natural Gas Corp. Houston, Texas	625	2–16	Intrastate line in North Carolina
Northern Natural Gas Company Omaha, Nebraska	1355	2–30	New lines and loops, Minnesota, Wisconsin, Alberta, Texas, Oklahoma, Kansas, Nebraska, Iowa
Northern Plains Natural Gas Company **(subsidiary of Northern Natural Gas Company)** Omaha, Nebraska	1100	26	Alberta-Montana border to Minneapolis, Minnesota
Offshore Gathering Company Houston, Texas	364	30	Offshore gas line in Gulf of Mexico from Sabine Pass to Mississippi River
Pacific Gas & Electric Company San Francisco, California	1300	36	Alberta, Canada, gas fields to Antioch, California
Petroleos Mexicanos Mexico City, Mexico	130	22	Reynosa to Monterrey
Piedmont Gas Co. Hickory, North Carolina	78	2-8	In Gaston, Lincoln, Catawba, Caldwell, and Burke counties, N. Carolina
Pioneer Natural Gas Company Amarillo, Texas	116	6–16	New and replacement lines, Texas
Southern California Gas Co. **Southern Counties Gas Co.** Los Angeles, California	83	34	From Coles Levee to Newhall
Southern Natural Gas Company Birmingham, Alabama	371	4–20	Various lines in Louisiana and offshore
Tennessee Gas Transmission Company	556	30	South of New Orleans to Portland, Tennessee
Houston, Texas	76	24	Coudersport, Pennsylvania to Hamburg, New York
	163	30	Loop from Portland, Tennessee and Winchester, Kentucky to Lancaster and Morehead, Kentucky
	39	26	Loop from Catlettsburg, Kentucky to Broad Run, West Virginia
	12	26	Loop south of Mercer, Pennsylvania
	50	26	Loop from Morehead, Kentucky to Catlettsburg, Kentucky
Texas Eastern Penn-Jersey Corporation Shreveport, Louisiana	65	30	Loop from Delmont, Pennsylvania, to Lambertville, New Jersey
Texas Eastern Transmission Corporation	105	30	Loop from Vidor, Texas to Kosciusko, Mississippi
Shreveport, Louisiana	140	30	Loop from Kosciusko, Mississippi, to Uniontown, Pennsylvania
	22	14	New line, Rayne 30-in. line
Trans-Canada Pipe Lines, Ltd.	492	30	New line from Kapuskasing, Ontario, to Sheridan, Ontario, Canada
Calgary, Alberta, Canada	48	24	New line from Winnipeg, Manitoba to Emerson, Manitoba, Canada
Transcontinental Gas Pipe Line Corporation Houston, Texas	375	3–36	Main line loops, laterals, extensions to system
Trans-Western Pipe Line Company Los Angeles, California	775		Four Corners area to point in California

can you use this seal?

+1000°f.



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Met-O-Seal

MET-O-SEAL was developed by the Franklin C. Wolfe Company to provide a practical answer to *no-leakage* sealing at extreme temperatures. Here are just some of the advantages obtainable:

- Lower machining costs
- Less flange weight
- Can not blow out
- No loss of structural strength
- No leakage!

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creative leader in fluid systems

OUTLOOK FOR 1958:

Prospective Good Year . . .

These are the bright spots:

- *Plans for increased construction*
- *Continuing increase in crude oil demand*
- *Far from saturated gas market*
- *More rapid advancements technologically*
- *Further easing of steel shortage*

THE PIPELINE INDUSTRY will not take a backward step in 1958. Despite views that business generally may slump to some degree, there are sound reasons why the transportation of gas, crude oil, and refined products will continue on the upgrade. Ever-increasing consumption of crude oil, a far from saturated gas market, and a normally increased products consumption should assure satisfactory throughputs, and additional pumping capacities plus new construction to satisfy these demands. Percentagewise these increases may not be as great as for 1957, but this is in line with the estimated increase in petroleum consumption of 2.6 percent, which is less than during the past year.

Several factors lend an air of uncertainty. Adverse court decisions and harmful legislation could keep expansion from developing as planned. Shortage and cost of capital funds also could be a retarding factor. But all these problems may be solved satisfactorily for the industry, in which case it would have a burgeoning effect. On the bright side, too, is the easing of the steel shortage, which began in 1957 and is expected to continue.

On one phase of pipelining there is no difference of opinion and no doubt in anyone's mind: Technologically the industry is in for greater and more rapid advancements than in the past. This is said with the awareness that great strides have been made within recent years. Expected, is increasing utilization of lease automatic custody transfer, main line metering, automatic operation of stations, supervisory and telemetering circuits, electronic computers to solve engineering and operating problems, and advancements in ditching, pipe handling, automatic pipe welding, etc.

As is the custom of *The Pipeline Engineer*, we asked leaders in the industry to favor us with their beginning of the year opinions on the outlook for 1958. Some have gone even further and extended predictions into the future several years. You will be interested in the various viewpoints that follow.

A Threatening Political Future . . .

F. O. Prior, *President*
Standard Oil Company (Indiana)

AS far as economics and technology are concerned, the outlook for the pipeline industry in 1958 is bright. Pipelines will continue to serve the public and the oil industry with distinction. There will be expansion as required, and increasing competition for the available traffic. New methods, procedures, and equipment that will improve service and reduce costs as they have in the past will be developed and adopted.

However, I am deeply concerned about the political outlook. Despite a truly remarkable record of improved efficiency, expansion to meet evergrowing needs, and rates that have resisted the inflationary trend, the pipeline industry faces a threatening political future.

Our political problems center on the fact that many of the people in Washington are blind to real facts about the pipeline industry. They conduct investigations, make unfounded charges, and arrive at conclusions unsupported by the testimony.

Typical is the report of the Senate Subcommittee on Antitrust and Monopoly, dated August 16, 1957. This report recommended that the Department of Justice initiate an immediate investigation of the pipeline industry.

The report urged investigation of "monopolization of common-carrier pipelines transportation, including extent of interest in trucking companies; use of controlled pipelines to deny independent producers a competitive market for crude oil; use of controlled pipelines to restrict sources of oil to independent refineries; crude oil price discrimination against producers, and pipeline proration."

with some question marks

But shadows are cast by:

- *Governmental investigations*
- *Outcome of Natural Gas Bill*
- *Shortage and cost of capital funds*
- *Extent of the mild business recession*

These allegations are made by people who don't know—and who didn't avail themselves of opportunity to learn—the facts about the pipeline industry. It is significant that the announced scope and subject matter of the hearing gave no intimation that these aspects of the pipeline industry would be covered.

For example, the charge that pipelines discriminate against independent producers, denying them access to market or to a crude oil supply, was based on the testimony of three individuals although there are more than 12,000 individuals and companies producing oil in the United States. There was no testimony at all to support the allegation relative to independent refiners.

During the investigation, no questions were asked about the pipeline industry's performance. There was little or no chance to emphasize that pipeline rates have been running counter to the general inflationary trend of recent years in all other transportation costs. The public couldn't learn from this hearing that pipeline rates are actually lower than they were in 1950.

The investigation failed to disclose that every refiner (except those located on water or supplied by local production) has at least one pipeline connection, and that the Interstate Commerce Commission has had no complaints from shippers about pipelines although there have been many against other means of transportation.

Neither was there a chance to tell the story of competition in oil transportation—competition that, with technology, has pushed the pipeline industry to spectacular achievement in service to our nation.

There was a discerning, informed, dissenting report. The dissent logically criticized the majority conclusion as being based on unsupported and erroneous statements which the pipeline industry had no opportunity to refute. The dissent cited a letter from the Independent Producers Association of America stating that ownership of pipelines does not give oil companies an unfair advantage over independent producers. The dissent found the majority of the committee apparently unfamiliar with the fact that pipeline companies are adequately regulated as common carriers. The dissenting report brought out many other instances indicative of lack of information, shallow investigation, and uninformed conclusions in the majority report.

The Department of Justice has announced that it will conduct a many-phased investigation of the pipeline industry. I am confident that development of the true facts will prove that the investigation is unwarranted and unnecessary. This is a forceful example of the dangers which can come from false reports and political pressures.

There is no easy solution to the political problem we face. Our sound business methods can surmount any economic obstacles, and our capable research can continue our technological progress. This is not enough. Although we realize that the pipeline industry has a wonderful story of public service to tell, we have not told this story effectively to the public. Now we must.

Informed public opinion is our best defense, and our only means of preventing or at least reducing the number of expensive, time-consuming, unnecessary, and harmful Washington investigations.

Here are some facts that are not generally known:

1. Common carrier pipelines are regulated by the Interstate Commerce Commission in the same manner as other forms of common carriers such as railroads, trucks, airlines, and water carriers. There is available to any shipper adequate protection against discrimination be it in service, rates charges, or whatever, through the ICC, or state regulatory agencies, or the courts.

2. The pipeline industry renders service to all shippers, regardless of ownership, at uniform fixed rates published with and subject to the jurisdiction of regulating bodies. Pipeline rates and service are applicable and available to all. Moreover, the competition among pipelines for available traffic is intense.

3. The pipelines, built entirely by private capital without subsidy of any kind, charge rates that are only about one-

fifth to one-fourth as much as the rates charged by the next most economical form of overland transportation.

4. The pipeline industry consists of an interconnected network of true common carriers serving every refinery in the nation except those built expressly to be supplied by water or local production. This is an industry with a splendid record of service to the nation in peace and war, an industry with justified pride in its technological and economic achievement.

The general public must be appraised of these and other factual data concerning the pipeline industry in order that it will realize how well pipelines are serving the public interest. Only an intelligent and aggressive program of taking the initiative in challenging misrepresentation and telling the real story will bring greater respect from the public and greater consideration from both the press and our legislative bodies.

To most effectively do this, those in the pipeline and oil industry must get out and tell the true story. It is not sufficient for us to serve the public well; we must take the offensive and stand and fight for what we know is right.

The owners and stockholders must encourage pipeline managements to speak up forcefully and aggressively. In addition, the pipeline industry must make full use of its organization, the Committee for Oil Pipe Lines, to speak for the pipelines as an important element of the transportation industry. Past experience shows that if we tell our story well, the press will give objective coverage that will carry the message to the public. Indifference to this necessity, by either the owners or the managers of the pipelines, will bring on additional governmental controls and restrictions. The inevitable result will be to raise costs and decrease efficiency, to the detriment of all — producers, refiners, marketers, and the public.

Some Disturbing Factors . . .

W. C. Kinsolving, *President*
Sun Pipe Line Company

WHILE we feel that the year 1958 will be a good year for pipeline operations, there are several factors which can seriously disturb the industry.

Foremost among these factors, and one which can pose a real threat to pipeline operations for the year 1958 and in the future, is the series of pipeline investigations that are now being conducted in Washington by the Department of Justice, the Celler Committee, and various other committees of Congress. It seems that periodically our industry must go through these trials and tribulations originating in Washington by so-called "defenders of the public welfare," mainly motivated by political ambitions.

It is too early to determine what will be the final outcome of these investigations. Some of the ideas now being expounded could be extremely detrimental, however. In fact, if by some stretch of the imagination some of them are accomplished, the effects could be disastrous. I shall make no attempt to outline in detail what these steps are, but only state that they are known by all those within the industry, and every attempt is being made to resist them to the utmost. It remains to be seen what can be accomplished.

The second factor, which, of course, is recognized by all, is how far the present slight business recession will go. Obviously, any trend downward in oil demand and consumption will have its adverse effect upon pipeline operations, since pipeline transportation is strictly dependent upon these demands. Some effects have already been noticed. In the report issued by the Interstate Commerce Commission for the third quarter of 1957, it is to be noted that the total transportation revenues for this quarter decreased 3.9 percent from the like quarter of 1956, and for the full three quarters of 1957 decreased 0.4 percent below the like period of 1956. This is the first quarter for some time showing a decrease.

Third factor affecting pipeline operations in the United States is directly tied in with the import situation. Since most of the imported oil is delivered to seaboard refineries, it can be seen that as imports go up and demand remains static, or shows very little increase, this results in a net decrease in pipeline traffic within the United States. The import situation, however, seems to have stabilized itself and probably will have very little further effect.

As for the construction of new pipelines, here again the action of the Department of Justice in interpreting the Consent Decree as regards the ability to capitalize borrowed funds for earning purposes will have a great deal to do with new construction. If some of its radical ideas are put into effect, there can be no question that construction of pipelines in this country will come to a halt, since no one could afford to build pipelines if the borrowed money cannot be capitalized into the valuation base for earnings.

Along these same lines, also, new building to some extent will be contingent upon the availability of borrowed money at reasonable interest rates. It is felt, however, that this is not nearly as important as the action proposed by the Department of Justice.

To sum this up, it appears that 1958 might be a year of considerable uncertainty. If these threats do not materialize, we can expect to go forward as we have in the past. If the threat of adverse legislation and adverse interpretation of existing laws by the Department of Justice is realized, the pipeline industry is in for hard sledding.

Throughput Will Increase . . .

Chas. R. Younts, *President*
Plantation Pipe Line Company

THE SOUTHEAST has continued, since World War II, as one of the fastest growing areas in the United States. Predictions are that this growth will continue but not at the phenomenal rate it experienced over the past decade. One indicator of this growth has been our own growth. The volume of refined petroleum which we transported increased from 29,000,000 bbl in 1947 to 91,700,000 bbl in 1956. In 1957 the volume transported exceeded 97,500,000 bbl. Electrical energy consumption has had a similar phenomenal growth.

We have estimated that our throughput increase during 1958 will be somewhat near the figure for 1957 — approximately six percent. Weather could be a factor in this; during the winter 1956-57 we experienced very warm weather with fuel consumption considerably less than anticipated and so far this winter the weather has been mild. An extended cold period would certainly increase our present daily pumpings. Nevertheless, the six percent increase mentioned for our

estimated pumpings is considerably above the 2.6 percent increase in petroleum consumption mentioned for the country as a whole for 1958.

In 1956, we paralleled our two main lines with an additional 18-in. diameter line out of Baton Rouge for 327 miles. During 1957 we strove for maximum utilization of the system's capacity. Larger impellers were installed at four satellite stations on our 10-in. main line, additional tankage at the source point (Baton Rouge) was built, and a larger pumping unit was added at another satellite station on the 14-in. main line. Additional shippers' facilities were added at 5 of our 18 delivery points and a new refinery, Pontiac, in central Mississippi, made connection with us for shipment of some of their products.

No major expansion is contemplated for 1958. We will, however, continue to modify the system to some extent and possibly will increase our capacity from approximately 304,000 bbl per day to 332,000 bbl. We are in a good position to handle our shippers' increased requirements as needed.

There are a number of technological improvements which we would like to see. We think improvements are due in meters, increasing their capacity and life while maintaining or bettering their accuracy; pipeline corrosion protection warrants more study; we feel that the design of and equipment for remotely controlled stations can be improved, and we know the development and adaption of electronic equipment for pipeline operations has considerable potentialities. These are some of the things we are working on by ourselves and with manufacturers. We are sure others in the pipeline industry are doing the same. This industry has shown a remarkable refinement in operations over the years and will continue to do so.

The summation would not be complete without a tribute to the fine people in our pipeline industry and to the manufacturers' and contractors' personnel servicing the industry. With such people in our land, we can face the problems confronting us and solve them for the continued welfare of this country.

Automation Will Be the Watchword . . .

J. M. Linehan, *President*
Mid-Continent Pipe Line Company

I WOULD like to limit my comments on the outlook for 1958 to our own operations as an intrastate carrier of crude oil and natural gasoline in the state of Oklahoma.

ECONOMIC OUTLOOK. Of course the economic outlook for our company like most others in the industry depends largely on the outlook for the entire domestic petroleum industry. In view of this relationship, we anticipate an increase in volumes in 1958 but a lower rate of increase than in previous years. In general, I feel that the high level of product stocks and foreign crude imports will continue in 1958 to act as a restraint on our state regulatory bodies in setting allowable crude production levels.

EXPANSION OUTLOOK. Our company has expanded rapidly in the last 10 years, which has resulted in more than doubling our pipeline mileage and nearly tripling our annual rate of throughput. While we are keeping our plans flexible, we now anticipate no major additions or extensions to our system in 1958 other than continued modernization and automation of our present facilities.

TECHNOLOGICAL ADVANCES. Automation still seems to be the watchword in our company this year. Last year we connected several lease automatic custody transfer batteries and are now handling about 12,000 bbl per day on this basis. We anticipate additional leases will be converted to LACT this year using either dump tanks or positive displacement meters as measuring vessels.

Also, a few months ago we began delivering natural gasoline to the D-X Sunray refinery at Duncan, Oklahoma, on an automatic custody transfer basis using positive displacement meters. This year we plan to install positive displacement meters on all of our crude oil pipelines serving parent company refineries at both Tulsa and Duncan. After the completion of a satisfactory period of testing and comparing results with present methods, we plan to place all of these meters into automatic custody transfer service also.

Further research and development will be continued in regard to the use of more supervisory and telemetering circuits, automatically operated stations, and the adaption of high-speed electronic computers to our pipeline operations.

An Era of Rapid Expansion . . .

J. L. Shakely, *President*
Oklahoma Mississippi River Products Line, Inc.

THE PIPELINE industry may properly celebrate its 100th anniversary in 1959, as it originated almost simultaneously with the discovery of oil in 1859. Pioneers in the industry cannot be commended too highly for their successful efforts, under extreme difficulties, in the gathering and distribution of crude oil by pipeline to points of requirement.

Pioneering and expansion in the industry in the distribution of natural gas is likewise commendable.

We are now in an era of rapid expansion in pipelines for the distribution of gasoline, light burning fuels, and jet fuels. Increasing quantities of liquefied petroleum gases are being transported by pipelines and stored underground in many areas and made available to consumers across the nation.

The economy to consumers in pipeline transportation has been proved. The industry has the experience and ability to meet the expanding needs of the consuming public and to maintain these services at minimum cost.

Healthy competition exists within the pipeline industry. There are no problems, political or otherwise, that cannot be solved within the industry. Perhaps, however, we have been negligent in not advising the consuming public of our functions, services, and price economics. Certainly, we, together with our representatives in government, are in position to open the doors of understanding to others across the nation. If the consumers of gas and petroleum products who reside outside the "oil country" would instruct their governmental representatives to come into the "oil country" for enlightenment, we could tell a most understandable story. Should our operations not be shown as beneficial to the consuming public, then let the hearings in Washington be resumed.

More Pipelines to Meet Customer Growth . . .

L. T. Potter, *President*
Lone Star Gas Company

LONE STAR Gas Company, since it was organized almost one-half century ago, has experienced a steady and vigorous growth, climaxed by the past decade during which its customer count has almost doubled and its property, plant and equipment account has more than doubled.

Now, as our company ends another year in which favorable results were achieved in operations, we look with optimism to 1958. Located in the heart of the Southwest, one of the fastest developing areas in the nation, we expect our rapid growth to continue at its current rate of from 25,000 to 35,000 customers annually.

To meet the requirements of these new customers our transmission pipeline capacity will be increased both by the laying of new pipelines as well as by the reinforcement of those already in service. New distribution pipeline footage also will be laid in practically all of the 455 Texas and Oklahoma cities and towns on the Lone Star system. This increased pipeline capacity is essential as new customers are added and as the gas requirements of the 803,000 customers presently connected to the system continue to increase.

Our anticipated peak demand for this winter is approximately eight percent above last winter's maximum demand figure. The gas reserves position of the company is excellent, with additional sources of supply in adequate amounts being connected to the system as they are developed. Four underground storage reservoirs, having a total storage capacity of more than 50 billion cu ft of gas, further insure dependable supply. The company cooperates closely with large and small oil and gas producers, from whom we purchase approximately 85 percent of our gas, in the development of new reserves, and our wholly-owned subsidiary, Lone Star Producing Company, conducts vigorous exploration and development operations.

The gas pipeline industry has before it a bright future. Growth continues, and public acceptance of gas as a fuel for home and industry has never been higher. This does not mean, however, that the industry can slow down on the excellent selling job that has been started. This campaign must be intensified on both the national and local levels, for selling the advantages of gas as a fuel to the public remains one of our most important jobs. Basic to this task are the continuing coordinated efforts of the research laboratories and appliance manufacturers to make gas appliances and equipment the safest, most efficient, most economical and most modern units available to the American consumer public.

Canada's Reserves to 200 Trillion Cu Ft . . .

Frank M. McMahon, *President*
Westcoast Transmission Company

The past year will be known as the most important year in the natural gas pipeline industry of Canada. It was during 1957 that both the 30-in. Westcoast Transmission Company, Ltd., pipeline from the Peace River area of northeastern British Columbia and northwestern Alberta to the International border near Vancouver, British Columbia, and the 34-in. Trans-Canada Pipe Line from Alberta to eastern Canada were placed in operation.

These pipelines made possible the first major marketing of Canadian gas and their completion marks the beginning of a new era for Canada's gas industry.

I think it is significant to note that since natural gas began moving to market there has been a marked increase in interest in the exploration for and the development of gas fields in Canada.

Today, instead of predicting that Canada may have 18 or 20 trillion cu ft of reserves, as the most optimistic did in the past, we find leaders in the industry predicting that reserves may reach in excess of 200 trillion cu ft. There is no way of telling how large our reserves will be — but I'm certain they will be huge and there is no doubt that northern and western Canada will become one of the major reservoirs of natural gas on this continent.

We have only started to find oil and gas in Canada. I doubt if there has been completed 10 percent of the exploration that will finally be done in the vast sedimentary area that stretches into three provinces, on to the Yukon, the Northwest Territories, and eventually to the Arctic Ocean.

The operation of oil pipelines has led to a tremendous expansion in oil development in Canada. Operation of natural gas pipelines will have the same effect in development of natural gas resources of the western Canadian area.

With the increasing population in Canada and increasing demand for Canadian products in the world's markets, gas will play an important part in industry and in providing a high standard of living for the Canadian people. In addition, there will be made available increasing supplies of surplus gas for export to markets in the United States both in the east and in the west. This Canadian gas will be a very valuable supplement to the energy supplies in the area in which it can be most profitably used by United States consumers.

Competition Will Be More Intense . . .

George S. Patterson, *President*
The Buckeye Pipe Line Company

WHILE it seems to be the opinion of most economists that the moderate decline in the general level of business will continue in 1958, a slight increase in the demands for petroleum products is forecast for the coming year, which should be reflected in pipeline deliveries.

The increase of some three percent in domestic demand for 1958, estimated by the Independent Petroleum Association of America, can be expected to affect the activities of The Buckeye Pipe Line Company and other independent carriers.

Competition in every phase of the industry will be more intense and Buckeye is endeavoring to meet this challenge by constantly looking into new areas for expansion of our activities and modernizing our facilities by automation and remote controls. This modernization program within the Buckeye system will continue and, likewise, we expect to complete some new projects during 1958.

Ga Pipelines — 750,000 Miles by 1965 . . .

S. D. Whiteman, *President*
Kansas-Nebraska Natural Gas Company, Inc.

THERE seems to be no question but that the gas industry in the United States will continue to experience a steady growth in the foreseeable future. Statistics prepared by the American Gas Association bear ample testimony to that fact.

Total industry assets are expected to increase from $19 billion in 1957 to $24 billion no later than 1960. The pipeline network of over one-half million miles today is expected to stretch to over three-quarters of a million miles in 1965. This will mean industry expenditures of between one and three-quarters billion and two billion dollars per year for the immediate future.

And, the gas industry has by no means yet reached customer saturation. There are about 100 million gas appliances in use today, but it is expected that 300 million additional gas burning units will have been sold by the end of 1975.

So, the ever-present challenge to the gas industry is just as overwhelming as it has ever been, and it will be met with the same forthright determination that has made the gas industry such a strong, integral part of the American way of life and economy.

Naturally many obstacles will have to be hurdled — some now present, others unforeseen. I would like to mention three immediate problems, each in itself of a most serious nature, which present themselves.

Volumes have been written and spoken about the Harris-O'Hara Bill, and I will not attempt to elaborate here except to say that the entire industry is now in general agreement that this bill should be passed. However, the coal interests are proposing certain amendments to the bill which could give it a complete boomerang effect. If, through the federal regulation of direct industrial sales, the gas industry is forced out of the industrial market, then not only would the entire industry suffer immeasurably, but its present customers also would be severely penalized by way of higher rates. I believe the economy of the entire nation would suffer. If such amendments are attached they most certainly will result in the defeat of this much-needed legislation.

Furthermore, there are movements afoot to either eliminate or sharply reduce the depletion allowance. Year by year the odds against finding new reserves of oil and gas become greater and greater. For example, offshore exploration has imposed tremendous risk on the producer, but the search must go on, and the producer must have the incentive to continue his efforts. I believe that when all of the facts of this matter are placed before the Congress, its members will recognize the basic need for continuing the depletion allowance provision in its present form.

A third problem — one of great urgency — lies immediately before the gas industry. It arises from traditional policy of the Federal Power Commission in allowing no more than a six percent rate of return in practically every rate application. The sharp increase in the cost of raising capital, which presently is being experienced, makes it imperative that the Commission review and revise its policy in this regard if the industry is to obtain the large sources of funds necessary to finance the expansion demanded of it by the American public.

Growth in our industry will continue, and, with it, the growing pains. I have every confidence that we can surmount the roadblocks that lie ahead. The job will be done by a determined, unified, stronger-than-ever gas industry team.

California's Gas Needs Ever-Increasing . . .

Guy W. Wadsworth, Jr.
President and General Manager
Southern Counties Gas Company of California

THOSE of us charged with supplying the energy needs of Southern California as early as the end of World War II were confronted with two related and inevitable developments, both of which are indelibly connected with the pipeline industry.

Indigenous supplies of California natural gas were to reach a plateau and, if anything, would begin to decline. At the same time the state's population — particularly that of Southern California — would skyrocket.

As this is being written almost to the day of the tenth anniversary of the completion of the "Biggest Inch" pipeline in late fall of 1947 the more than 1,000,000,000 cu ft of gas Southern Counties and Southern California gas companies are importing each day from Texas and New Mexico producing fields constitute the single largest source of energy for this area.

From the original single 30-in. diameter line which joined the transmission system of El Paso Natural Gas Company at the California-Arizona border, the Texas-Pipeline Transmission system of the two Southland utilities has grown to three 30-in. lines, at a cost to the two local companies of almost $89,000,000.

The upward trend in population and an almost simultaneous downward curve in California gas production have followed our expectations.

Our projections for future gas requirements show the two Southern California gas companies will have to acquire an additional 100,000,000 cu ft of gas a day, each year from now until at least 1975 to meet energy needs of residential and industrial customers in their service areas.

Total potential gas requirements this year will have been 1,720,000,000 cu ft a day. By 1975, our total potential requirements will have climbed to 3,700,000,000 cu ft daily.

California production available to the two companies currently hovers around the 530,000,000 cu ft a day mark. By 1975, the local supply will have dropped to 420,000,000 cu ft.

Inevitably then, gas supplies increasingly will have to come from out of state. In addition to supplies presently being procured from Texas and New Mexico fields we are looking to Canadian, Rocky Mountain, and southwest U.S. sources.

Southern California continues to grow, continues to need more energy, and as far as we are concerned that means more and more natural gas pipelines.

At a time when some are forecasting a softening of the country's economy the outlook for the pipeline industry in California looks extremely good.

A Favorable Year in 1958 . . .

L. H. True, *President*
Magnolia Pipe Line Company

CONSTRUCTION of new crude oil and product pipelines will continue in 1958, but probably at a somewhat slower rate than has been experienced in the past few years. Existing facilities will continue to expand as required to handle an increase in movements.

In recent years rapid strides have been made in the use of automatic equipment. Recent developments, improvements for greater dependability, and experience in use of this type of equipment indicate rapid growth in automation in the future.

There has been a gradual increase in the use of positive displacement meters in the custody transfer of crude petroleums. Installations of this type will increase rapidly in the future.

Increase in movements of LPG products by pipeline will continue to expand.

Some easing in the steel pipe shortage has been experienced in the latter part of 1957. This will probably continue through 1958.

In general, prospects indicate a favorable year in 1958 for the pipeline industry.

Governmental Activity Threat to Progress . . .

D. L. Rankin, *Manager*
Wyco Pipe Line Company

YOUR invitation to personally comment on the outlook for the pipeline industry is intriguing. It appears that since the oil pipeline segment of transportation is faced with a series of investigations and law suits by various governmental agencies the industry will proceed with caution. Such activity by the Federal Government may not only delay or defer worthy pipeline projects, but in some cases might block further consideration of possible developments.

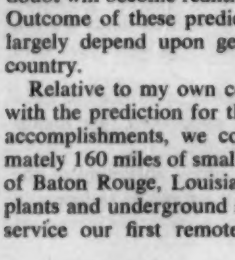
As an example, basic economics require that for a gas field to obtain practical value and produce revenue a pipeline must be constructed from the source of supply to an interconnecting carrier or an adequate point of consumption. Elimination of price control of natural gas at the wellhead undoubtedly should expedite expansion for the natural gas industry by both producers and carriers. However, the next step involves all pipelines — products, crude, and natural gas — and the petroleum industry must be given a complete exoneration against charges in order to survive and maintain a free economy. The ultimate effect probably would be more far-reaching than the public is led to believe if an unfavorable decision is handed down. A principle of not permitting the earning of profit from borrowed money, once applied to any industry or portion thereof, probably could be applied to all industries and all enterprises.

It appears that competition in the future will demand that all new pipelines and expansion of present facilities be constructed to operate as completely automatically as possible. Older facilities will probably continue to modernize to permit economic and competitive operation.

With a continued increase in domestic demand most pipeline companies will study their existing facilities from time to time to ascertain that sufficient pipeline capacity is available to meet forecasted demands. The essential facilities will probably be constructed as necessary. Wyco Pipe Line Company, like other pipeline companies, is making studies from time to time, but currently has no definite plans.

Emphasis On Improved Techniques . . .

Phelan H. Hunter, *President*
Interstate Oil Pipe Line Company



PRESENT indications and plans point to an average year for the pipeline industry in 1958. Forecasts for throughputs are expected to be comparable to 1957 or slightly above. There are some new pipelines programmed or planned for construction during the forthcoming year. Research and developments are proceeding at a steady pace, and new technological projects now in the planning and testing stages no doubt will become realities and be placed in service in 1958. Outcome of these predictions, as you are well aware, will largely depend upon general economic conditions of the country.

Relative to my own company, the outlook is in keeping with the prediction for the industry. In reviewing our 1957 accomplishments, we completed construction of approximately 160 miles of small diameter LPG lines in the vicinity of Baton Rouge, Louisiana, to connect with new chemical plants and underground storage in the area. We placed into service our first remotely controlled unattended electric pump station, and before the year is out we will have another semi-automatic electric pump station onstream. This station will be operated by a field gager and will be placed on the line early in the morning and will operate automatically for the remainder of the day.

In the research and developments area, we plan to continue our efforts of development and testing of high-capacity positive displacement meters. Considerable study is being given to the application of electronic computers in the solution of pipeline engineering and operating problems. Another study being conducted is one of better methods, procedures and equipment for underwater tie-ins, particularly in the Gulf Coast area.

Concurrently we will continue to handle routine matters such as connections to new producing areas, construction of gathering systems and lateral lines, and installation of additional pumping equipment where necessary for efficient operations.

We foresee a leveling off of pipeline construction for Interstate in 1958, with emphasis being placed on improving operating techniques and systems. We anticipate a gradual evolution of technological developments rather than radical changes and developments.

Pipelines Will Keep Pace with Demand . . .

Harry G. Fair, *President*
Phillips Pipe Line Company

ECONOMICS. Naturally, the pipeline industry, being closely related to the oil industry as a whole will be somewhat affected by the economic health of the oil industry. As demand for crude and products within the continental United States increases we can anticipate further advances in the pipeline industry.

POLITICAL. Our business is building and operating pipelines and normally we leave political comment to the politicians. However, with the pipeline industry currently under attack on at least two congressional fronts, it is impossible to ignore the political and public relations phases of our business. We subscribe to the thoughts expressed by Max Burns and Charlton Lyons at the recent API Convention in Chicago. While specific accusations must be handled by the pipeline companies against which they are directed, it also appears in order at this time for the pipeline industry, as a whole, to take the offensive.

TECHNOLOGICAL. Technological advances will continue to be made in the construction end of the business in improved ditching and pipe handling equipment and there will be still further advances along the lines of automatic pipeline welding. In operations we foresee a continuing swing to automation, particularly automatic, unattended pumping stations.

EXPANSION. In the light of curtailment of runs we do not expect the normal expansion in 1958.

Steady Improvement Through 1958 . . .

D. M. Morrison, *President*
Trans Mountain Oil Pipe Line Company

JUST as the advent of the Suez incident placed a load on some transportation facilities that was beyond the carrying capacity of the systems, thereby instituting accelerated expansion, so it was impossible to halt immediately the momentum of the work that was underway when the emergency ended so abruptly. Trans Mountain greatly benefited from the impetus given by Suez, but by the same token the enhanced expansion now leaves the system with spare capacity that will take care of normal growth for some time to come.

This situation will permit a breathing period with opportunity to consolidate right-of-way, physical equipment, finances, and personnel, which breathing time in Trans Mountain's case is not unwelcome.

Starting from the low point in volume through which we are now passing we anticipate a steady but rather slow improvement through 1958 and a much better long term outlook. Meanwhile the growth and product diversification of the refining industry in Southern British Columbia and the U.S. Pacific Northwest is proceeding as anticipated and Trans Mountain is confident that the major portion of the crude supply in this area will come from Canadian sources.

Instrumentation, Communication Improvements . . .

F. Hill Sanders, *President*
Mid-Valley Pipeline Company

AT THE present time, it appears to me that things are pretty indefinite. I do believe that we will see a normal expansion, particularly in big pipelines, provided the Federal Government does not step in and stop the construction of such by the major oil companies. I also believe that the technological field will carry on and develop more instrumentation and communication improvements than we have seen over the past few years.

As far as the economic outlook is concerned, from my personal viewpoint, it appears that we cannot break a record each year by producing more than we did in the past. Therefore, I believe that 1957 has been a leveling off period and that in all probability 1958 will see a slight increase over 1957 but not a marked one. In our particular line, it appears that we will transport about the same quantities that we did in 1957.

Energy at Favorable Prices to Continue . . .

Stuart F. Silloway, *President*
Pacific Northwest Pipeline Company

OUTLOOK for the natural gas pipeline industry continues to be satisfactory.

A very substantial volume of capital spending by corporations over the last 10 years has added greatly to productive capacities to the end that considerably more competition exists in most industries and a lesser volume of capital spending is now in prospect.

It seems likely, however, that a somewhat larger volume of residential construction may occur in 1958 and that governmental spending will continue high at all levels, despite Federal Government economy moves.

The nation's total economy in 1958 is, therefore, likely to be less robust than in 1957. Perhaps a decline in general activity slightly greater than either of those which occurred in 1949 and in 1954 is in the offing.

Nevertheless, the natural gas pipeline companies should continue to provide energy at favorable prices in comparison to Btu's in other forms. Therefoe, demand fo natural gas should continue to incease, but expansion of facilities may be limited somewhat by shortage and cost of capital funds. Money market stringency may also result in a reduction in well drilling, thereby restricting somewhat the availability of new gas supplies, although this may be offset by a greater disposition on th epart of some companies to drill acreage on which gas may be developed in recognition of a ready market. and stable price.

Market Only Partially Saturated . . .

E. Clyde McGraw, *President*
Transcontinental Gas Pipe Line Corporation

THE outlook for Transcontinental Gas Pipe Line Corporation is one of continued growth. Market area served by the company has only reached a fraction of saturation for natural gas and I anticipate a constantly increasing demand for many years. Temporary dislocations, such as variations in supply, the cost of capital, and difficulties created by adverse court decisions or legislation, may keep our expansion from being carried on at a constant rate but will not decrease the pressure from the market for continual expansion.

A Year of Adjustment . . .

F. E. Kalbaugh, *General Manager*
Southern Pacific Pipe Lines, Inc.

IN MY opinion, the year 1958 will be one of adjustment. Industry in general, and the pipeline industry in particular, should be prepared to foresee and make these adjustments as they occur. The pipeline industry, with its advanced technology and ever-improving methods, is now in position to take advantage of every opportunity for advancement.

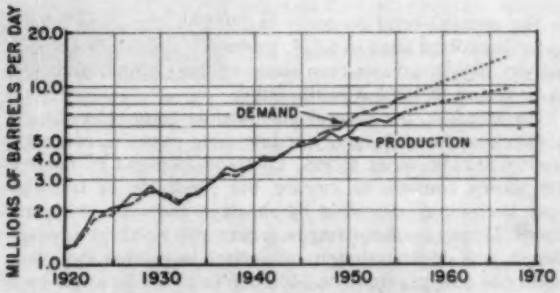
These Curves Are Important To Pipelining of the Future

PIPELINING of the future is tied in closely with these curves, which are the product of engineering appraisals of our oil and gas reserves and ultimate utilization of them.

Obviously, the curves will be sawtoothed and a major development could alter them radically. This sawtoothed effect comes from depressions, temporary oversupplies, and peaks of high national production.

In the role of primary fuel source, oil and gas eventually may fade, giving way to atomic, solar, free radical, or solid fuels. But, as can be seen from these curves, this is far in the distant future.

If these predictions do prove correct it is obvious that transportation must be supplied for moving higher volumes to market, in the immediate future, and pipelines, affording the best means of transporting them, must continue to expand.



Source: The Chase Manhattan Bank "Future Growth of the World Petroleum Industry" U.S. Bureau of Mines

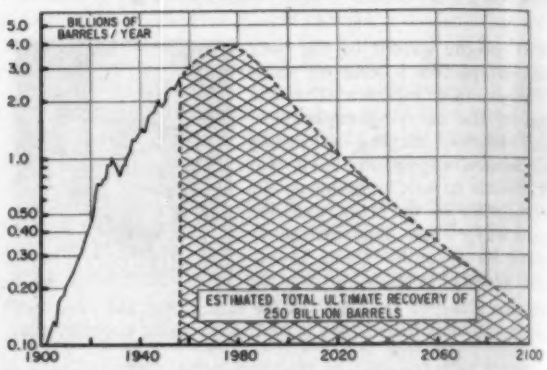
FIG. 1. Domestic production and demand of crude oil.

An Increasing Need for Pipelines . .

R. K. Paine, *Manager*
Pipe Line Department
Standard Oil Company of California

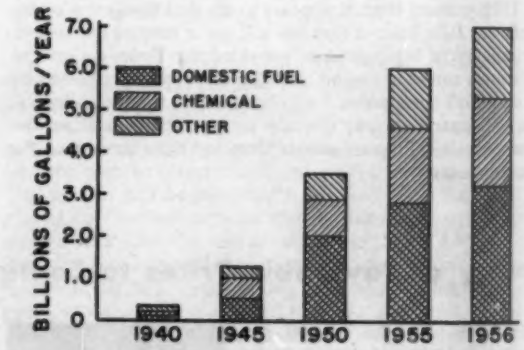
OUR industry continues to be one of progress and development. The spectacular gas, crude, and products lines which are under construction or announced show that our people are alert to the coming needs of the world and that society has an increasing need for our form of transportation.

Existing systems will keep pace with other changes of today's industry. Automation of trunk line stations will continue, although perhaps at a lower rate than before. New forms of modernizing, such as automatic custody transfer and main line metering, can be seen in the future as pipeliners stay ahead in the modern world. ★ ★ ★



Source: The Chase Manhattan Bank – "Future Growth of the World Petroleum Industry" U.S. Bureau of Mines.

FIG. 2. Computed pattern of crude oil production in the United States.



Source: U.S. Bureau of Mines.

FIG. 3. Consumption of LPG.

LPG and products lines may even reverse their flows in the distant future as the U. S. becomes dependent on foreign sources of oil. (This is not an unheard of idea — Tuscarora has reversed directions of flow a number of times.)

Some of the factors that will affect pipelining in the immediate future will be the increased development of oil and gas reserves in the Rocky Mountain region and the possible discovery of major fields in eastern Pennsylvania and New Jersey, which are now under the close scrutiny of the geophysicists and the geologists. ★ ★ ★

WHAT'S AHEAD FOR THE CONTRACTOR?

James P. Neill, *President*
Pipe Line Contractors Association

THE PIPELINE ENGINEER'S annual pipeline construction survey indicates that the year 1957 will see the completion of 25,413 miles of natural gas, oil, and products transmission lines in the United States and Canada. And 1958 will be an even bigger year for pipeline construction — the same survey indicating some 27,689 miles planned or proposed for that period.

It takes very little imagination to realize that the pipeline contractors, faced with the responsibility of constructing such a tremendous mileage of pipeline in almost every part of the North American continent, have a difficult problem ahead of them. Regardless of the complexity of the problem, however, the pipeliners, through experience gained from past jobs, through ingenuity or through sheer guts, have been able to come up with a solution. This is particularly true where features of terrain or topography encountered on any given pipeline route create problems of a different nature than those encountered on any other route.

One problem that has been common to all pipeline construction jobs for a number of years, and one that has been a bottleneck in many recent construction jobs, has been the shortage of skilled welders. During recent times an almost chaotic situation has arisen wherein contractors have found themselves bidding against each other for welders services, and offering bonuses, pay for time not worked, extra hours, free trips, or any other inducement that would produce another welder. It soon became quite obvious that this problem was one that could not be solved by the individual contractor and the problem was therefore passed to the Pipe Line Contractors Association.

The association's answer was to provide the industry with more skilled welders by establishing a pipeline welding school at an initial cost of $125,000. Plans were formulated to establish a Pipeline Welding School at Kilgore, Texas, under the supervision of the Petroleum Extension Service of the University of Texas. The Welders Union has agreed to assist in the program and applications are now being taken for students. The first class is scheduled to start January 13, 1958, with good prospects for a capacity class indicated.

The Pipe Line Contractors Association has high hopes for the continued success of the school and that it will continue to receive the support of not only contractors and the union, but feel that the school also merits the support of pipeline companies who also will benefit in this endeavor to lower construction costs.

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CONTRACTORS ASSOCIATION REACHES 10th MILEPOST

THE PIPE LINE CONTRACTORS ASSOCIATION reaches a milepost with its annual convention in Boca Raton, Florida, January 18-22. This will be its Tenth Anniversary meeting. As such, special recognition will be given past presidents and honorary members, the latter representing some of the real old-timers in the business. These men will be presented with bronze plaques at the banquet Tuesday night.

A well-rounded program has been arranged, which will include association business sessions, a group of prominent speakers, and the usual excellent entertainment. The complete program follows:

Saturday, January 18

6:00 p.m. — Pre-convention cocktail party for officers and directors.

Sunday, January 19

All Day — Golf tournament begins, courtesy Polyken Sales Division, The Kendall Company, Chicago, Illinois.

7:45 a.m. — Early Birds breakfast, Patio Royale, courtesy Insley Manufacturing Company, Indianapolis, Indiana.

10:00 a.m. — Special meeting, Auditorium. Regular members only.

2:00 p.m. — Meeting of Board of Directors, Room 601.

5:30 p.m. — Cocktails, Cloister Loggia, courtesy Perrault Equipment Company, Tulsa, Oklahoma.

7:00 p.m. — Buffet dinner and dance, Cloister Loggia and Patio Royale, courtesy H & L Tooth Company, Montebello, California.

Monday, January 20

9:30 a.m. — General business session, Auditorium. (Open to all).

1. Call to order and welcoming address, James P. Neill, president.
2. Report of the executive secretary, Richard A. Gump.
3. Address by D. A. Golden, president, Northern Ontario Pipe Line Crown Corporation, Ottawa, on construction in Canada.
4. "The Money Market vs Pipeline Expansion," Tom P. Walker, chairman of the board, Transcontinental Gas Pipe Line Corporation, Houston, Texas.
5. Address by Curtis M. Smith, president, Southern Gas Association, and vice president, Tennessee Gas Transmission Company, Houston, Texas.
6. Presentation of safety awards.

12:00 Noon — Luncheon and water show for all ladies attending the convention, Cabana Club Swimming Pool, courtesy Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.

12:00 Noon — Cocktails in Cloister Loggia and luncheon in Patio Royale for all men, courtesy M. J. Crose Manufacturing Company, Inc., of Tulsa, Houston, Denver, Newark, and Edmonton.

2:00 p.m. — Golf tournament continues.

6:00 p.m. — Cocktails and steak roast, Cabana Club, courtesy Caterpillar Tractor Company, Peoria, Illinois.

Tuesday, January 21

9:30 a.m. — General business session, Auditorium. (Open to all).

1. James P. Neill, president, presiding.
2. Henry Wallace, vice president, National Tube Division, U.S. Steel Corporation, Pittsburgh. Subject: Line Pipe.
3. Address by Clark Breeding, partner, Peat Marwick Mitchell & Company, Dallas, Texas, on tax matters, with particular reference to travel, entertainment and reimbursed expenses.

11:00 a.m. — Closed business session for regular members only, Auditorium.

1. James P. Neill, presiding.
2. Reports of committees.
3. Election of officers and directors.

12:00 Noon — Luncheon and style show by Burdine's in Patio Royale, courtesy Crutcher-Rolfs-Cummings, Inc., Houston, Texas.

3:00 p.m. — Awards for winners of golf tournament, Patio.

6:00 p.m. — Cocktails in Cloister Loggia, courtesy International Harvester Company, Chicago, Illinois.

7:30 p.m. — Annual banquet and floor show, Patio Royale.

Wednesday, January 22

8:00 a.m. — Breakfast meeting of Board of Directors, Polo Room.

10:00 a.m. — Meeting of regular members only, for discussion of labor matters, Auditorium.

The 1957 CROP OF NEW IDEAS HOLDS PROMISES FOR THE FUTURE

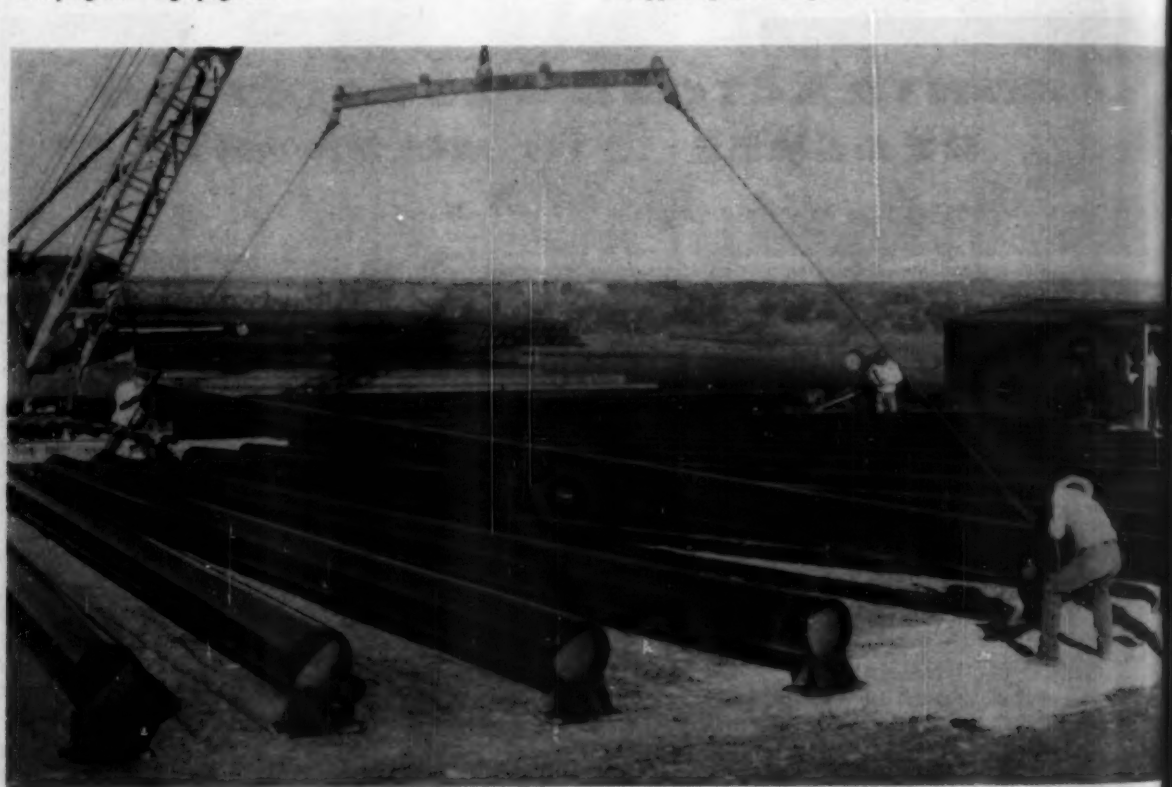
Donald M. Taylor
Gulf Coast Editor

THE DARK DREAM HAUNTING the pipeliner's house trailer is that one day pipelines — like railroads — will all be built and construction will grind to a halt never to start again. But there are strong factors that have been working to keep this grim dream from becoming a reality.

For one thing, pipelines provide the most efficient means of transporting fluids, gases, and several solid products. So long as the market for these products continues to grow and their source continues to change, pipeliners will keep on laying the "big spaghetti."

More important still, is the fact that pipeliners are continually improving the efficiency and lowering the cost of constructing pipelines (considering today's inflation, pipelines are being laid dirt cheap). Every year brings incredible improvements. And it is these improvements that make it possible for contractors to submit lower and lower bids (again considering inflation) to build better and better lines.

Here are a few of the new and refurbished old ideas that cropped up on the rights-of-way in 1957.



1. New Spray-On Pipe Coating is Getting Its First Major Test

A new pipe coating that may revolutionize pipelining is being given its first major test on Transcontinental Gas Pipe Line Corporation's McMullen County line near Tilden, Texas. The coating, made of epoxy resin, coal tar, and a catalyst was sprayed on 17 miles of pipe ranging in size from 10 to 16 in. The coating goes on the pipe just like house paint — only the thickness is a scant 11 mils (which is 8 mils above the 3-mil anchor base of the pipe).

Transco will lay the pipe just as though it were bare and the sections of line will be given a careful test to determine whether or not the new coating is applicable to large diameter cross-country lines.

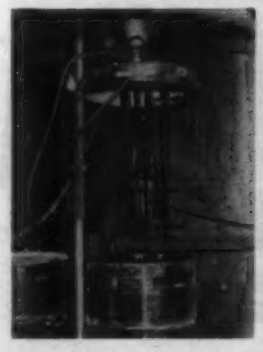
If the coating lives up to its laboratory tests, it may well prove adequate for any line. The dielectric strength of the new material is about 700 v per mil of thickness and its toughness and flexibility are remarkable to say the least.

The test Transco has lined up for the coating will be severe. No particular pains will be taken to protect the coating from rough handling during stringing and construction. After the pipe has been bent and welded, the weld areas will be taped or painted with a quick-set formulation of coal tar and epoxy, and lowered into the ditch. Then the current requirements of the insulated sections will be determined and field studies of the new material will get underway.

Actually the material is not new. Transco engineers have been experimenting with it for three years and last year the company coated and laid a short length of 6-in. line in South Louisiana for corrosion studies. In the laboratory the epoxy, coal-tar mixture has proved excellent. One of the tests most important from a corrosion standpoint was conducted over a period of several months. Holidays were made in the coating deliberately to see how it would perform during the actual cathodic protection. Normally, the process of cathodic protection builds up an alkalinity at the holiday. Some coatings fail because of this alkalinity, blistering and peeling. The new coating, however, is not affected adversely by the alkalinity and no undercreeping has been observed.

This means that even if the coating has holidays, the pipe can be protected successfully simply by imposing sufficient current.

H. C. Price Co. set up the pipe coating yard and Transco and Price engineers have been working jointly to overcome the bugs in field application of the coating. Most of the engineers connected with the project feel that a highly efficient means of applying the coating is not far in the future.

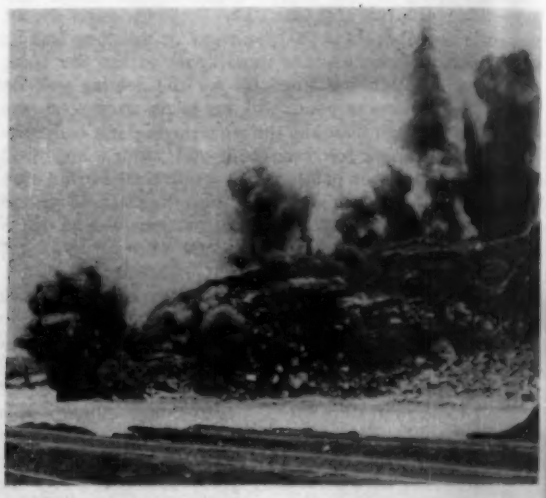


2. One-Shot Cleaning, Coating Machine Makes Hay With Tape

With the advent of tape coating it was but a short time until a machine that will both clean and coat the pipe was developed. This one-shotter will also apply an outer wrap of pipeline felt.

3. Ditch Padder Throws Rocks Away

A number of machines for padding ditches in the rock country has been developed recently. One of them consists of an endless belt-like grid that lets dirt and rocks less than one inch in diameter fall into the ditch while giving larger rocks the heave-ho. Backfill is pulled onto the grid with a backfill bucket.



4. Using Fertilizer for Rock Blasting

Ordinary ammonium nitrate right out of the garden shop can be used to greatly lower the cost of blasting where ample holes can be drilled for the purpose. The fertilizer is mixed with diesel oil, and set off with prima cord and a small quantity of dynamite that acts as a detonator.

Developers of the new technique say the "powder factor" — the ratio of pounds of blasting agent to cubic yards of earth — is the same as that of conventional blasting agent. Usually this runs from ¼ lb per cu yd of loose gravel to 1½ lb for hard rock.

It has been used successfully in 2, 4, 6, 8, and 9 in. holes for mining, quarrying, and general construction.

5. Automatic Double-Jointing Unit Paid Off in Canada

An automatic double-jointing rig that can be moved out on the right-of-way by three floats and a trailer has proved highly successful in Canada this year. Designed for 24 to 40-in. line, the equipment has proved able to turn out about ten 30-in. welds per hour using only 16 men. Here's the way it works:

Pipe is fed onto the racks with a sideboom tractor, and

..ALWAYS WITHIN ARMS LENGTH

CROSSING INSULATORS

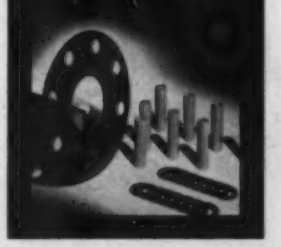
Truly rugged crossing insulators, the Maloney Models 55 and 57 shown are in addition to the wrap-around Model 56 crossing insulator in the complete line developed in the Maloney Research and Development Laboratory shown above. In crossing insulators, as in other products, Maloney research has set *new* industry standards.

SCRAPER CUPS

The unique lip design of the Maloney scraper cup insures complete effectiveness throughout the life of the cup. Completely adaptable to out-of-round and other adverse conditions, the Maloney scraper cup *has no equal*. If time is a factor, F. H. Maloney is *'within arm's length.'*

CASING SEALS

This zipper type casing seal is equally suited for new or replacement applications. The zipper joint assures a dust-tight, water-tight seal — installs in minutes. Slip-on types for new applications are also available. *Both* compensate for eccentric installations without any special handling, and are available to *you immediately*.



FLANGE INSULATION

Maloney Flange Insulation sets include all components for each joint; central gasket, sleeves, and washers of linen base Bakelite. High pressure applications are available with a Neoprene faced central gasket — *eliminating* any other gasket seal. Another result of *continuous* Maloney research.

ETTING *NEW* STANDARDS FOR THE INDUSTRY

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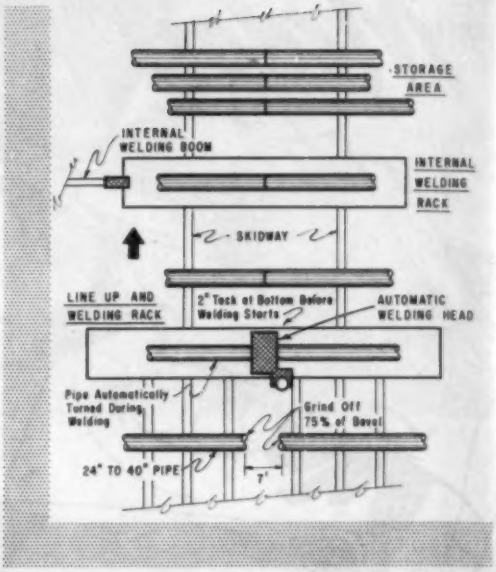
the ends to be welded are spaced 7 ft apart. High speed (360 cycle) grinding wheels remove approximately 75 percent of the bevels and the rack feeds the pipe onto the line-up and welding rack. Here the ends are butted and lined-up with internal hydraulic, push-button line-up clamps. A welder makes a 2-in. tack weld at the bottom, and then the submerged arc welding head goes into action. This head is mounted in a full floating carriage that automatically maintains a predetermined off-center and vertical head position. This compensates for any dog-legs.

The pipe rotates during the welding at a rate of about 100 in. per min during the first pass and about 75 in. per min during the second and final pass.

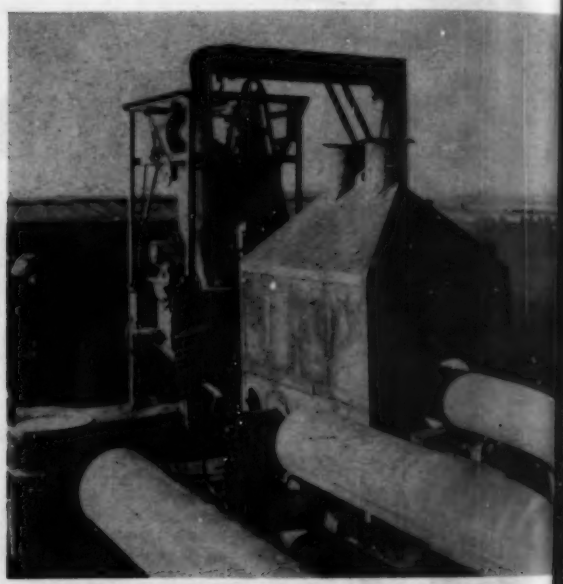
Hydraulic rams kick the pipe out of the rack and it feeds onto the internal welding rack. Here a man enters the pipe on a dolly, lines up the internal head, and observes the welding.

This entire welding rig can be disassembled and moved in about 8 hours. (*See The Pipeline Engineer*, October 1957).



6. A 360-ft Stinger Lowers Pipe Onto Gulf Floor

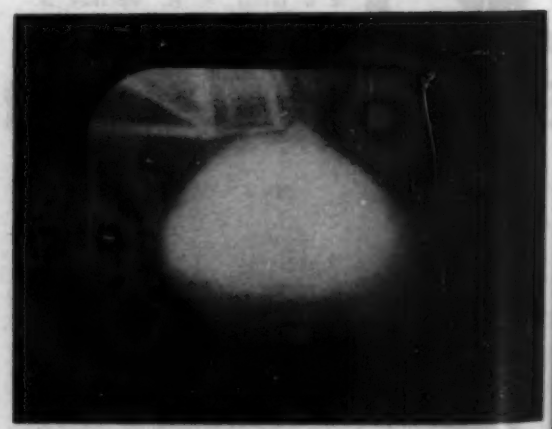
Brown and Root's new 300-ft lay barge, the M-211 is equipped with a 356-ft long stinger that cradles the pipe onto the Gulf floor with minimum breakage of the concrete coating. Made of large diameter pipe with idler rollers for the pipe, the buoyancy of the stinger can be controlled according to the weight of the pipe and the depth of the water.



7. Line Laid in 300-ft of Water Gives Birth to Many New Ideas

When Submarine Pipeline Construction Company, Inc. laid a 7-mile 22-in. line in the Pacific new ideas just had to come — this was the world's longest underwater pull.

From time to time, the construction forces sent divers underwater for inspection purposes. They carried an underwater TV camera that allowed the men in the barge to view the line.



8. Detecting Coating

By running a cathodic protection cable in water with the pipe as it is launched and keeping the line under cathodic protection constantly it is possible to detect any damage to the coating the instant it occurs. A break will cause instruments to indicate higher voltage requirement.

9. Sea-going Sled

This sea-going sled will serve as a final anchor for the pipeline which ran out to the 300-ft contour line in the Pacific. Pontoons reduced its weight to only 1000 lb during pull, and a water-tight plug maintained the lines flotation. The sled was made of reinforced concrete, yet none of the steel contacted the pipe.

The pipeline was launched by pulling against huge anchor assembly spotted 2 miles beyond end of the line in 660-ft of water. Anchors reportedly could take a pull of 1,000,000 lb.

10. New Instrument

It is called a Teilurometer and it reportedly measures distances by radar to fantastic accuracy. The probable error is 3 parts per 1 million plus or minus 2 in., in distances up to 35 miles. This error would amount to less than one foot at a distance of 20 miles.

The instrument was developed by the South African Council for Scientific and Industrial Research. It will work night or day, in clear or foggy weather. It consists of one master unit and two slave units — one of the latter must be at one of the instrument points and the master at the other.

11. Zinc Bracelet Anodes For Undersea

Zinc anodes fitted around a pipeline like a bracelet, extended flush with the concrete coating provide protection for an estimated 40 years. They were invented by Tennessee Gas engineers and used on the company's offshore lines.

12. Pipeline Floats to Sea

Western Pipe Line Inc., suspended a pipeline beneath the water and hauled it out into Port Lavaca Bay, then lowered it into the ditch. These floats are highly adaptable to any marine operation. They will clamp together, in any possible combination and they are center balanced. Winches on the floats position pipe beneath them.

Keeping records of each engine is important. Shown here is operator logging information on Daily Engine Log. Note convenient rack on engine for logs.

DAILY ENGINE LOG Station No.____

Month Day Engine No.

TIME	ENG RPM	WATER TEMP		OIL TEMP		WATER PRESS	OIL PRESS	SCAV PRESS	CRNKCASE PRESSURE	EXH TEM
		IN	OUT	IN	OUT					
1 2AM										
2AM										
4AM										
6AM										
8AM										
10AM										
12NOON										
2PM										
4PM										
6PM										
8PM										
10PM										

Pipeline Fundamentals

PART 2. Operating Inspection Records

Preventive Maintenance Practices for Gas Engines

Homer Ramsey, *President*
Ramsey-Terry Machine Corporation

Donald M. Taylor
Gulf Coast Editor

KEEP *adequate* records of gas engine operation and maintenance, *use* them properly, and in most instances you can predict major engine troubles ahead of time. Moreover, you can correct many troubles in early stages, and thus minimize emergency shutdowns.

But just what do we mean by *adequate* records and how do we *use* them properly?

Adequate records are functional — first and last. Records kept for record's sake are not only useless, they tend to obscure the messages and trouble warnings that can be found through proper analysis of engine records. For this reason, it is far better to keep too few records and interpret them carefully than too many records and interpret them loosely.

There are three main functions of engine records. The first is that of saddling field personnel with certain duties in regard to operation and maintenance. One of the important aspects of these duties is that making routine inspections takes operators and maintenance men close to each of the engines at frequent intervals. Their familiarity with normal sound grows, making them better able to detect an unusual engine noise, which almost always accompanies any serious failure or malfunction.

A second function of engine records is to establish failure and wear patterns. As the permanent records of engine operation and maintenance grow, wear patterns become apparent — as do failure patterns of specific engine parts. The greater the number of engines the greater the value of these records.

For instance, records compiled over a period of years will show that rings of a certain make operating in a particular make of engine will — under similar conditions — have to be replaced after so many hours of operation. The same holds true of other engine parts.

This pinpointing of specific engine troubles makes it possible to reduce engine maintenance costs. If, for example, a certain make of engine develops bearing troubles — followed soon after by another and still another engine of the same make and model — it is obvious that the cause of trouble should be found and corrected before another similar engine fails.

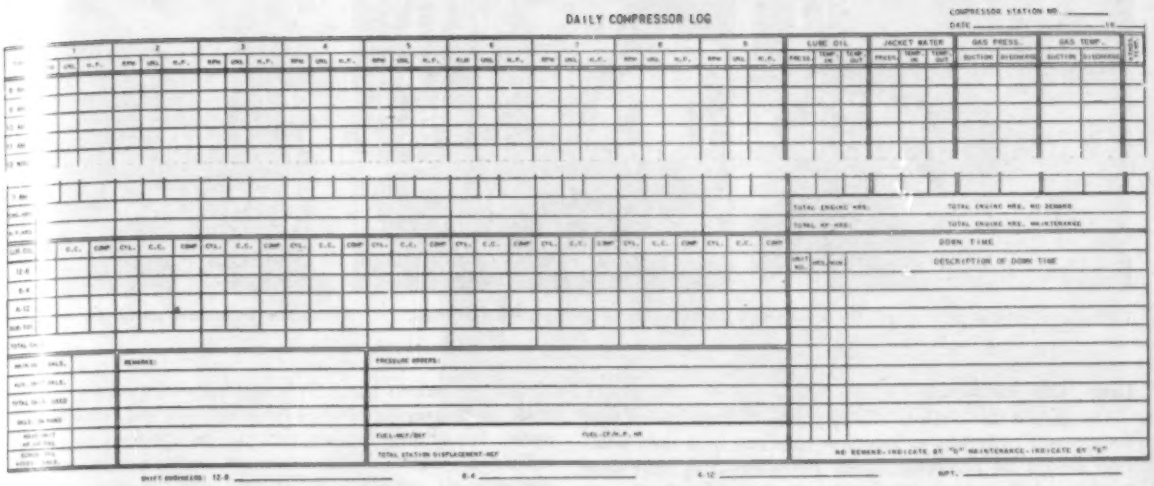
Aside from detecting trends and trouble patterns, engine records are helpful in judging efficiency of maintenance personnel and predicting maintenance expense for next year's budget. Frequency of ring and bearing replacement can be forecast accurately, as can the expected life of spark plugs. But the ability to do this depends on the amount of study given the records and the simplification or boiling down of information about them.

In the following discussion, when we refer to various periods of inspection, replacement, etc., we are picturing the engines operating under so-called "normal" conditions. Fuel gas is assumed to be clean, and air is considered to be fairly free of heavy dust most of the time. Of course, these "normal" conditions do not exist at many stations — and spark plugs, for instance, that would operate for 40 days or so on one engine, may not last five days on another that uses inferior fuel gas, etc.

This section does not deal with overhaul reports. They are important and will be treated in a separate section.

DAILY INSPECTIONS AND REPORTS

The Daily Engine Log and the Daily Compressor Log shown are typical of the gas transmission industry. Notice that the log for individual engines is recorded every two hours, and from the information thus obtained the large Daily Compressor Log is made up. The latter in many instances contains averages and summaries of information recorded at the individual engines. Most times the smaller log is filed at the compressor station and the larger one sent to headquarters office where its information is sifted and used to prepare records that will be helpful in maintenance analysis.


DAILY COMPRESSOR LOG

COMPRESSOR STATION NO. _____

DATE _____ 19__

LUBE OIL | JACKET WATER | GAS PRESS. | GAS TEMP.

TOTAL ENGINE HRS. | TOTAL ENGINE HRS. NO DEMAND

TOTAL HP HRS. | TOTAL ENGINE HRS. MAINTENANCE

DOWN TIME

DESCRIPTION OF DOWN TIME

REMARKS:

PRESSURE ORDERS:

NO DEMAND-INDICATE BY "D" MAINTENANCE-INDICATE BY "S"

SHIFT ENDINGS: 12-8 _____ 8-4 _____ 4-12 _____ MPT. _____

Engine RPM

The need for accuracy in taking engine rpm cannot be overstressed. For one thing, there are critical speeds at which particular engines should not be operated because of excess vibration and perhaps engine failures could occur. Also, horsepower curves are based on rpms, and this, too, should be plotted accurately for proper engine analysis.

Oil Temperatures

High or low lube oil temperatures can mean trouble. For this reason, they should be recorded frequently. Most companies prefer the two-hour interval for this record.

Water Temperatures

Jacket water inlet and outlet. This information is needed on an immediate basis to be sure that ample cooling water of proper temperature is passing through the engine jackets.

Lube oil cooling water. This should be checked and recorded primarily as an operating practice because it will vary most often with the ambient temperatures and malfunctioning of cooling equipment.

Water and Oil Pressures, Exhaust Temperatures

Water pressure. Water pressure should be taken every two hours. This is important because, if it is not done at regular intervals, an eight-hour shift might pass without checking and a rise or fall of pressure could mean big trouble. Low pressure due to circulation pump failure could cause serious damage before automatic cutoff could stop the engine.

Lube oil pressure. As operating time is built up on engines, this record becomes more and more important and should be taken about every two hours, as an oil failure can put you out of business fast. Also, an excessive amount of oil not only is a waste of money but also can cause trouble, such as building up carbon, fouling plugs, etc. A high-pressure reading would mean an obstruction in the oil line or passage. A low reading could mean a worn wrist pin bushing, or in the case of oil-cooled pistons a leak, or a broken oil line inside the engine. Also, the main bearing could be worn.

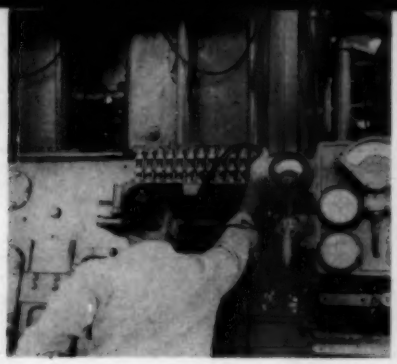
Exhaust temperatures. From the indicating pyrometer on engine or engine board, exhaust temperature of individual power cylinders can be determined. This reading and recording should be done every two hours. A high reading on one or two cylinders could mean carbon in the ports of two-cycle engines, faulty ignition, clogged air filters, faulty valves, or an over-heated piston. *Do not use a pyrometer to balance an engine.* Quite often a low temperature is misleading if it is only on one or two cylinders. More times than not, one or more cylinders will grab most of the load from the other cylinders but will record low temperatures because they are pulling an excess amount of air across the pyrometer element causing it to record low.

Taking rpms with tachometer.

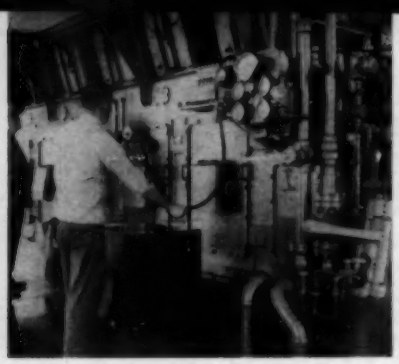
Checking lube oil temperature.

Inlet lube oil cooling water and jacket water.

Instrument panel on engine. Operator checks lube oil pressure and jacket water pressure. Instrument at upper left is for taking exhaust temperatures of individual cylinders.



Taking oil level in power cylinder lubricator.



Adding oil to power cylinder lubricator.

Checking crankcase oil level.

Lube Oil Records

Oil should be added to the lubricator for the power and compressor cylinders at frequent intervals and each addition should be carefully noted. Moreover, the individual bobbers or droplets in the lubricator should be checked at intervals to be certain they are working properly.

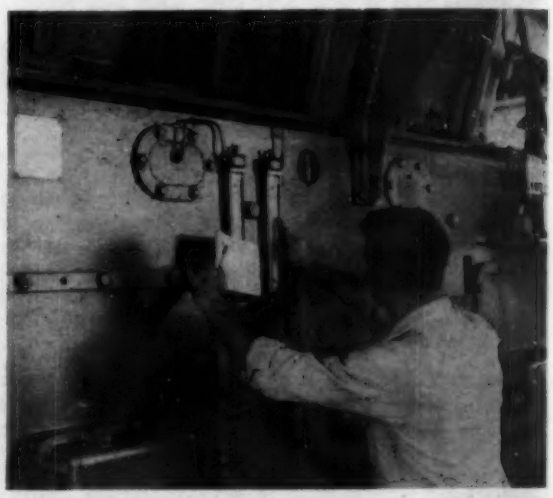
The engine manufacturer will recommend the amount of oil for the various parts. This will vary with oil and conditions, so by keeping records and observing the cylinder and piston conditions this amount can be changed to fit the individual engine. Filter element life is a good way of checking oil performance. If the time between changes steadily reduces, then something has happened to the oil and your supplier or oil technician should be consulted.

Crankcase and Scavenging Air Pressures

Crankcase pressure. This pressure should be taken often, about every two hours. This recording is important as an increase in pressure means blowby of combustion gases. A gradual rise will mean that the rings are wearing out or the cylinder is wearing. However, a sudden rise means a broken ring or rings. The engine manufacturer will recommend the normal pressure, generally about 0.04 in. of mercury. Excessive blowby will contaminate the crankcase oil.

Scavenging air pressure. This is taken for more or less short-term maintenance problems. A sudden rise indicates the cylinder is wearing. However, a sudden rise means a valve failure or clogging of the air cleaner. After several years of operation, if the pressure is low and the valves are working properly and the air cleaner is clean, then the piston ring on the scavenger compressor is worn or the cylinder on the air compressor is worn.

By keeping and studying reports after a few thousand hours of operation, a set time for cleaning parts can be determined, if air, oil, and fuel gases are normal. Normal pressure is 4½ to 5½ in. of mercury on most engines.



Jacket water and crankcase manometers.

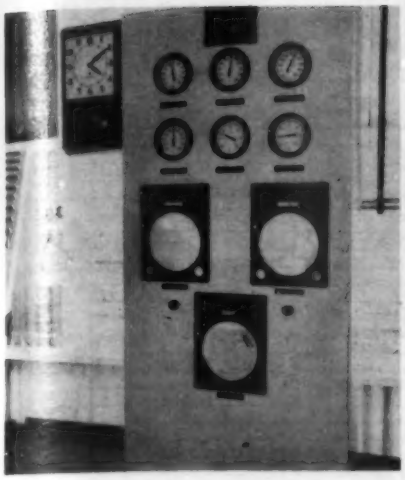
Wiping Engine, Feeling Bearings

Wiping and cleaning engines. Practical engine men with years of experience have found that a clean engine generally is an engine in good operating condition. Not that the cleanliness has anything to do with the proper functioning of the engine, but if the men in the engine room spend most of their time cleaning and polishing the engines they soon learn the normal sounds or noises and are quick to note any strange ones.

With our present day instruments and controls, it would be possible to get all engine information on a central panel and men would not have to go near the engine. But experience has taught that men around an engine are invaluable. An experienced man can tell by the action of the valve tappets, etc., whether the valve is functioning properly. By feeling outboard bearing and crankcase doors, he can sometimes spot hot bearings before damage is done.

Wiping engine has important function.

Feeling for hot bearings.

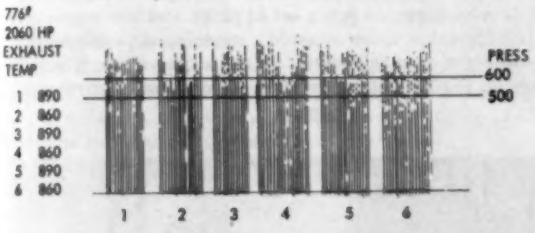


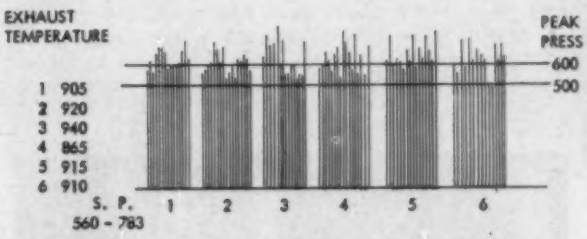
Control Board

Station suction and discharge pressures, starting air pressures, outside and inside temperatures, and other important readings are taken here. In regard to starting air, be sure piping will stand 300 psi and is large enough to carry ample volume to the engine. Size of pipe will depend on the distance the volume tank is from the engine. Also see that drain cocks are on the line and tank at lowest point. These should be opened often so as not to get any condensate in the power cylinder. A soap base lubricant should be used in the air compressor to eliminate any chance of getting oil in air lines. Sometimes the air line will explode from carrying an excess amount of oil.

Calculating Engine Horsepower

One of the important duties of operators at any station is to calculate engine horsepower. In most stations a set of manufacturer's curves based on suction and discharge pressures and temperatures at various rpms makes it possible to calculate this factor. Its importance insofar as maintenance is concerned is to show overloads, and to relate lube oil consumptions, etc., to horsepower hours. A great amount of damage can be done to an engine if it is operated any length of time overloaded. If all the facts were known, most scoured power cylinders, scuffed pistons, and cracked heads could be traced to an overloaded engine. An engine in good repair should run a short time overloaded while minor repairs are being made on another engine. Likewise, an engine not carrying its rated load is not making the money it should.





Indicator card (above) of engine out of balance — spiking. Indicator card (at right) of same engine in better balance.

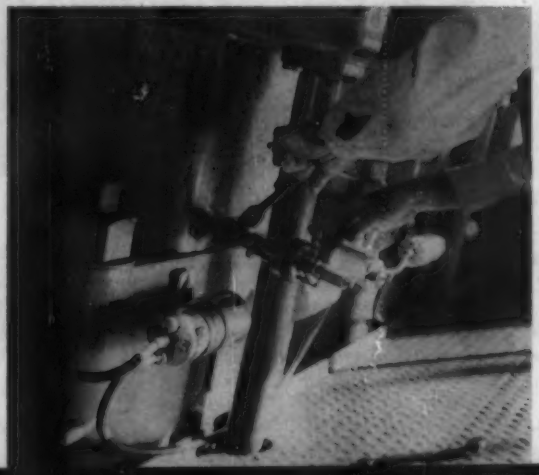
WEEKLY INSPECTIONS AND RECORDS

For some reason or other, the seven-day interval is not too important to engine operation and maintenance insofar as routine inspection and repairs are concerned. Anything that does not need inspection daily, usually does not need inspection more frequently than once a month. However, some have found by keeping and studying records, that some of the daily records can be moved up to weekly.

Indicator cards. An exception to the weekly records kept by most companies is the pulling of indicator cards and balancing of engines when necessary. This is a controversial subject. There are many who believe that every four or six months is enough. It takes only a few minutes to pull a card and balance an engine, which will result in a much more efficient engine. Before balancing an engine, be sure the timing is right, parts are cleaned, air cleaner is not clogged, scavenging valves are working properly, and ignition has been checked.

Follow engine manufacturer's recommendations for fuel valve opening, generally 0.015 hot and 0.010 cold. Balance each cylinder until all cylinders are within the recommended compression range. Most engine manufacturers recommend adjusting fuel valve tappets once a day.

Taking indicator cards. Piston movement not recorded — only peak pressures.



COMPRESSOR STATION MONTHLY OPERATING SUMMARY

COMPRESSOR STATION NO. _____

DATE _____ TO _____

	MAIN UNITS										AUXILIARY UNITS			
	1	2	3	4	5	6	7	8	9	TOTAL	1	2	3	TOTAL
A. TOTAL ENG. HRS. TO DATE														
B. ENG. HRS. POSSIBLE FOR MO.														
C. ENG. HRS. OPERATED FOR MONTH														
D. ENG. HRS. OFF - NO DEMAND														
E. ENG. HRS. OFF - MECH. FAILURE, ETC.														
RATIO C/B														
RATIO CRE/B														
F. POSSIBLE RATED HP. HRS. - MO.														
G. ACTUAL HP. HRS. DEVELOPED														
RATIO G/F														
POWER CYL. OIL USED - GALS.														
CRANKCASE OIL USED - GALS.														
COMPR. OIL USED - GALS.														
TOTAL - GALS.														
HP HRS/GAL.														
RECLAIMED OIL														

TOTAL FUEL - CF - _____

FUEL CF/HP. HR. - _____

STATION DISPLACEMENT - MCF _____

PEAK DAY DISPLACEMENT - MCF _____

DATE OF PEAK _____

LUBE OIL PURCHASES

P.O. NO.	MANUFACTURER	TRADE NAME	GALLONS

TOTAL OIL ON HAND FIRST OF MONTH GALS. _____

TOTAL OIL PURCHASED THIS MONTH GALS. _____

TOTAL OIL AVAILABLE THIS MONTH GALS. _____

TOTAL OIL DISBURSED THIS MONTH GALS. _____

BALANCE ON HAND LAST OF MONTH

METER READINGS - MAKE UP WATER GALS.

PRESENT _____ LAST MONTH _____ DIFFERENCE _____

REMARKS: _____

COMPILED BY _____

APPROVED BY _____
SUPERINTENDENT

MONTHLY OPERATING REPORT

This is the most important report thus far discussed. In fact, insofar as maintenance is concerned, primary purpose of the daily engine log and the daily compressor log is to supply information for this report. By analyzing information given here and comparing it with that of previous months, trends often can be ascertained and wear patterns fixed. More important, at the year's end management will know exactly how much it has cost to pump fuel gas and lube oil, what the maintenance costs were, and can tell which is the most efficient station from the standpoint of available horsepower and the above costs. It is easy to see that a small amount of fuel gas, lube oil, or maintenance saved on one engine, when multiplied by hundreds of engines on a large system, represents an overall saving of "big money."

Every month — or thereabouts — engines should be given a number of inspections and remedial maintenance should be carried out. For instance, one company has found by keeping and studying records that their spark plugs will run 35 days; this figure was increased from 21 days. They have eight 10-cylinder engines in one engine room, so every 35 days each engine gets a set of plugs, and one engine gets a fuel injection valve assembly, meaning each engine runs about eight or nine months on the same valves. Every 70 days an engine gets an overhauled interrupter or magneto.

Changing spark plugs.

Spark Plugs

Spark plugs should be cleaned and points set at 0.015-0.020. This is important because as the plug gets dirty and the gap increases the fire becomes weaker causing the engine to miss and sometimes stall.

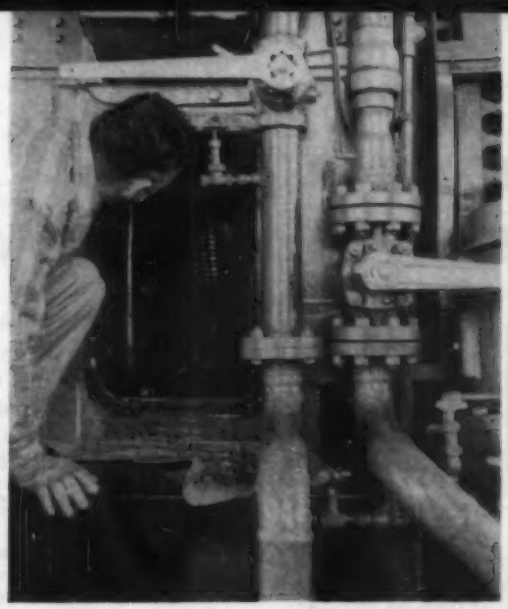
Removing cover to check interrupter.

Interrupters

Be sure that breaker point clearance is set according to the engine manufacturer's recommendation.

Crankcase Inspection

As a rule, crankcase inspection is not needed every month. However, good maintenance practice is to inspect thoroughly at least one crankcase at this interval of time until you can set a time for inspection by referring back to the records. Drain oil, clean out sludge, and look for loose babbit. Most generally, if any loose babbit is found, pull bearing over the babbit for inspection. With a light hammer tap main bearing nuts; if there is a dead sound this means a loose nut. Main drive and the gears also can be inspected at this time.



Checking crankcase. Note chain drive.

Injection Valves

Most fuel valves are fitted with an alemite fitting. A high melting point grease should be used sparingly about once a week. *Caution* — over-greasing may cause the valve system to gum up and stick. Check valve stems often for signs of leaking around stem, some have a packing that can be adjusted, others have a seal ring that must be replaced. Be sure the injection system is properly timed and with the proper clearance. Also see that the valve is seating properly. It is well to have spare valves in good repair for replacements.

Changing injection valve.

Scavenging Air Valves

Most scavenging air valves are of the strip type, sometimes called finger or feather valve. If the scavenger pressure is normal, generally the valves are working properly. Here again is where an experienced operator who spends a lot of time around the engine can detect an unusual sound, a pecking to tapping noise. Quite often he can locate the broken valve with a stethoscope.

Removing cover to replace strips in scavenging air valves.

TEMPERATURE INSTRUMENT INSPECTION REPORT

STATION NO. _____

DATE	MAKE & TYPE	RANGE	LOCATION	OTHER PARTS NOT LISTED	REMARKS

SUPERINTENDENT _____

DATE _____

Temperature Instrument Inspection Report

This check should be made and recorded at regular intervals, say every 30 or 60 days. This does not take much time and is very important. Most companies use an accurate thermometer for this check.

ENGINE SAFETY CONTROLS INSPECTION REPORT

STATION NO. _____

DATE	UNIT NO.	OVERSPEED TRIPPED (RPM)	LUBE OIL PRESSURE (PRESS)	JACKET WATER TEMPERATURE (TEMP)	REMARKS

SUPERINTENDENT _____

DATE _____

Engine Safety Controls Inspection Report

Most companies check the safety control and overspeed shutdown, lube oil pressure, and jacket water temperature shutdown about once a month. Common practice is to speed the engine up and note the rpm the control tripped. Pinch off the oil flow and note the pressure when shutoff tripped, also note cut down on jacket water flow and temperature when control tripped.

The Pipeline Engineer's

1958 Pipeline Contractors Directory

Here is an up-to-date listing of both general and specialized pipeline contracting companies. Given are the firm names, addresses, telephone numbers, and chief contact in each company, as furnished by the companies themselves. Listed first are those firms that do general pipeline contracting. Specialized firms are listed on succeeding pages.

A

A & A Construction Company
3720 West Broadway
Box 1597
Muskogee, Oklahoma

A. B. C. Construction Co., Inc.
12420 South Bloomfield Avenue
Norwalk, California

Acme Construction Company
P. O. Box 80-W
Oklahoma City, Oklahoma
Meryl Carr

Aldridge-Poage, Inc.
Northern Belt Line
Lexington, Kentucky
Phone: 4-7279 & 2-7454
L. M. Poage, President

E. K. Aldridge & Sons, Inc.
Box 1324
Athens, Georgia
Phone: Liberty 6-6470
R. G. Aldridge, General Manager

H. F. Allison Company
6923 Scyene Road
Dallas, Texas
Phone: EV 1-3881
H. F. Allison, President

Altgelt Construction Co., Inc.
3502 Lawrence Drive
Box 1402
Corpus Christi, Texas

Andrews-Parker, Inc.
P. O. Box 927
Bryan, Texas
C. L. Andrews, President

APV Company, Inc.
1801 Continental Natl. Bk. Bldg.
Fort Worth, Texas
Phone: EDison 2-3397
A. "Pup" Vaughn, President

Arey Construction Company
P. O. Box 1501
Pampa, Texas
R. E. Arey, President

Ashy Construction Company, Inc.
P. O. Box 472
Eunice, Louisiana
Phone: 2294
M. Ashy, President

Asplund Construction Company
P. O. Drawer 1665
Enid, Oklahoma
George Asplund, Owner

B

Banister Construction, Ltd.
625 Northern Hardware Building
Edmonton, Alberta, Canada
Phone: 4-8147
R. K. Banister, President

Barry Construction Co.
4108 Old Spanish Trail
Houston, Texas

Bartholomew Contracting Co.
513-14 Gulf States Building
Dallas, Texas
Phone: RI 8-1092
J. G. Bartholomew, President

C. P. Bartley & Son
Box 616
Tioga, North Dakota
Phone: 4-3476
C. P. Bartley, Sr., President

Thomas Bate & Sons
P. O. Box 162
Bellaire, Texas
Phone: Mohawk 4-4505
R. W. Ramey

Baughman Contracting Co., Inc.
1210 National Highway, La Vale
Cumberland, Maryland
Phone: PArkview 2-4588
George E. Baughman, President

Bechtel Corporation
220 Bush Street
San Francisco 4, California
Phone: DO 2-4032
S. D. Bechtel, President

O. O. Berryhill
Box 3277
Temple, Texas

Joe Bland Construction Co.
4704 East First Street
Austin, Texas
Joe Bland, Owner

B & M Construction Co.
2808 First Natl. Bldg.
Oklahoma City, Oklahoma

Boecking Construction Co., Inc.
2810 North MacArthur
Oklahoma City, Oklahoma
H. E. Boecking, Owner

Briner Rust Proofing Co., Inc.
Box 984
Albuquerque, New Mexico

Brodie Construction Company
P. O. Box 2064
Amarillo, Texas
Phone: DRake 2-7928
J. T. Brodie, Owner

Broughton & Ericson
Box 12193
Addison Road
Dallas 25, Texas
Phone: AD 9-1712
O. J. Broughton, President

Marvin Brown, Inc.
P. O. Box 14117
4425 Du Pont
Houston, Texas
Phone: JAckson 3-2536
Marvin Brown, Owner

Brown & Root, Inc.
4100 Clinton Drive
Box 3
Houston, Texas
Phone: FAirfax 3-7121
L. E. Minor, Mgr. P/L Dept.

O. R. Burden Construction Corp.
6702 East 21st Street
Box 5216
Tulsa, Oklahoma
Phone: TEmple 8-3378
O. R. Burden, President

Burkhardt Construction Company
Grove Avenue & Homewood Drive
Lorain, Ohio
Phone: Broadway 7-6181 or Broadway 7-6184
Robert W. Burkhardt, President

C

Campbell P & H Company
958 Kentucky Street
Mobile, Alabama

Canadian Bechtel Limited
25 King Street West
Toronto 1, Ontario, Canada
Phone: EMpire 3-5737
S. M. Blair, President

Canadian Comstock Co., Ltd.
206 Laird Drive
Toronto, Ontario, Canada
Phone: HU 1-3461
C. C. Rathgeb

Canadian River Construction
1111 West Georgia Street
Vancouver, B. C., Canada
Phone: Mutual 3-6037
Robert Thomas, President

Cape Construction Company
P. O. Box 423
Cape Girardeau, Missouri
Phone: Edgewater 5-8204
R. B. Potashnick, President

Century Construction Company
P. O. Box 5175
8312 Mosley
Houston, Texas
Phone: HUdson 6-7129
George Caliva, President

Chambliss-Kirksey, Inc.
Box 218
Sweeny, Texas
Phone: 2285

Chaney & Hope
P. O. Box 7271
6414 Maple
Dallas, Texas
Phone: FL 2-6665
C. E. Chaney, President

Cheek Construction Company
Ulysses, Kansas
Phone: FL 6-1448
Troy Cheek, Owner

J. W. Christie
Frisco, Texas

W. E. Claycomb and Son
Route 1
Cody, Wyoming
Phone: 1494 or 783
W. E. Claycomb, President

Cole-Fontaine Construction Co.
Box 1501
Odessa, Texas
Phone: FEderal 2-1826
J. D. Silberman, President

Colorado and Wyoming Const. Co.
P. O. Box 357
Loveland, Colorado

Commercial Welding Company
10 Widgery Wharf
Portland, Maine

Conner Construction Company
Box 1047
Odessa, Texas
Phone: FEderal 7-0482
Jack A. Conner, Owner

Consolidated Construction Co.
Box 505
Cathage, Texas

Consolidated Gas & Service Co.
327 LaSalle Street
Chicago 4, Illinois
J. C. Donnelly, President

Construction Service Company
Lincoln Blvd. at Cedar
Box 311
Bound Brook, New Jersey
Phone: Elliot 6-2790
J. J. Senesy, President

Constructora El Aguila, S.A.
Reforma 30
Mexico, D. F.
Mariano Silva S.

Contracting & Material Company
1235 Dodge Avenue
Evanston, Illinois
Phone: Rogers Park 4-1294
W. P. Cagney, Jr., President

Contractors, Inc.
Box 422
Marshalltown, Iowa

Conyes Construction Corp.
13685 San Pablo Avenue
San Pablo, California
Phone: LA 4-1821
R. A. Conyes, President

R. L. Coolsaet Construction Co.
7600 Middlesex Avenue, Box 4087
Dearborn, Michigan
Phone: LUzon 1-6666
Remi L. Coolsaet, President

Counties Contracting & Const. Co.
Ninth Street & Sedgley Avenue
Philadelphia, Pennsylvania

Crain Bros. Inc.
Grand Chenier, Louisiana
Phone: Jennings, La. WJ 3-5529
J. P. Crain, President

W. G. Cullum & Company
1412 Fidelity Union Life Bldg.
Dallas, Texas
Phone: RI 1-4439
George P. Cullum, Jr., President

A. J. Curtis & Co.
P. O. Box 1072
Casper, Wyoming
Phone: 3-6433
A. J. Curtis, President

D

E. L. Dalton & Company
P. O. Box 7125
3003 Hawes
Dallas, Texas
Phone: FL 2-4843
W. E. Dalton, President

Davis & Armentrout Const. Co.
Main St., Box 785
Pulaski, Virginia
Phone: 3-4521
J. E. Davis, President

B. J. Davis Construction Co.
Box 117
Ashland City, Tennessee

George W. Davis Constr. Co.
1414 N. Eastern
Box 186
Oklahoma City, Oklahoma

J. M. Dellinger, Inc.
P. O. Box 4227
Corpus Christi, Texas
J. M. Dellinger, Owner

Diamond Engineering Company
8100 Second Avenue
Dallas, Texas
Phone: EX 1-2286
L. W. Webster, President

Donaldson Construction Co.
Dodge Center, Minnesota

S. W. Downer, Jr.
31 North Main Street
Glassboro, New Jersey
S. W. Downer, Jr., Owner

Dutton-Williams Brothers, Ltd.
North Canadian Oil Building
Calgary, Alberta, Canada
Phone: AMherst 6-8601
M. A. Dutton, President

E

East Coast Construction Co.
2272 East Mt. Carmel Avenue
Glenside, Pennsylvania

Eastern Pipe Line Contractors
820 Mercantile Building
Dallas, Texas
Phone: Riverside 1-4081

East Penn Construction Co.
Lancaster County
Landisville, Pennsylvania

A. J. Ellis Construction Co.
5555 Branchville Road
Box 98
College Park, Maryland
Phone: WEbster 5-3000
A. James Ellis, President

Engineering-Construction Co.
1st National Building
Tulsa, Oklahoma

Engineers Limited Pipeline Co.
225 Bush Street (General Office)
San Francisco 4, California
Phone: GArfield 1-2980

R. C. Ernst
Box 168
Evans City, Pennsylvania

Eubanks & Smith PL Const. Co.
Rt. 2, Box 470
Greenville, Mississippi
Phone: 5464
J. D. Eubanks, Co-Owner
J. L. Smith, Co-Owner

F

John D. Fahey and Son, Inc.
1st Natl. Bank & Trust Bldg.
Waynesburg, Pennsylvania

L. E. Farley, Inc.
Texas Gas Building
P. O. Box 6841
Houston 5, Texas
Lloyd Farley, Jr., President

E. E. Farrow Company
P. O. Box 7145
Dallas, Texas
Phone: RI 1-4048
E. E. Farrow, Owner

Fenix & Scisson, Inc.
5808 E. 15th St.
Tulsa, Oklahoma
Phone: TEmple 5-4459
S. E. Scisson, President

Ferguson Construction Co.
Box 127
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796 M & M Building
Box 2617
Houston, Texas

Fisher Contracting Company
2201 S. 19th Ave.
Box 6306
Phoenix, Arizona

C. N. Flagg & Company, Inc.
48 Elm Street
Meriden, Connecticut
Phone: BEverly 7-5581
Peter Flagg, President

Four-Way Construction Company
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Foran Construction Co.
500 Parker Street
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Amarillo, Texas
Phone: Drake 3-3244
William J. Foran, Co-owner
Joseph D. Foran, Co-owner

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North Kansas City, Missouri
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Phone: 84
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R. K. Banister, President

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2323 Erskine Road
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Lubbock, Texas
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R. H. Fulton, Owner

G

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Brownfield, Texas
Phone: 2560
Phil Gaasch, Owner

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John Gabrielse, Partner
Edwin Gabrielse, Partner
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Phone: HOmestead 5-2538
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Aurora, Illinois

H. L. Gentry Construction Company
921 East Michigan
Jackson, Michigan
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Lee George, Owner

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H. C. Brogan, President

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Oklahoma City 14, Oklahoma

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Lafayette, Louisiana
Phone: CE 5-1551
D. M. Glaser, Owner

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6450 Liberty Road
P. O. Box 15243
Houston, Texas
Phone: ORchard 2-0561
W. L. Golightly, President

Gragg, Inc.
223 West Britton Avenue
Oklahoma City 14, Oklahoma
Phone: Trinity 8-2127
C. Hubert Gragg, President

Gragg (Canada) Ltd.
295 Kipling Avenue South
Toronto 14, Ontario, Canada
Phone: CLifford 9-9211
C. Hubert Gragg, President

Grayco Constructors, Inc.
1201B West 34th Street
Box 4147
Austin, Texas
Phone: HOmestead 5-8797
Jack S. Gray, President

Gray-Morrison Contractors, Inc.
Box 4086
Austin,Texas
Phone: HOmestead 5-8797
Jack S. Gray, President

Gregg Construction Company
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Longview, Texas
William D. McMahon, President

Griffis-B&M
826 McBirney Building
Tulsa, Oklahoma
Phone: CHerry 2-1288
G. G. Griffis, General Manager

B. A. Gundelfinger, Inc.
2980 Johnstown Road
Columbus 19, Ohio
B. A. Gundelfinger, President

Gustine Construction Co.
603 West Main St.
Ardmore, Oklahoma
Phone: 5963
D. F. "Curly" Gustine, Owner

H

Hall Construction Company
Box 1004
Hugoton, Kansas

The Hallen Company, Inc.
45-30 37th Street
Long Island City 1, New York

Hallmac Construction Company
3701 Buffalo Drive
Houston, Texas
Phone: JAckson 6-1377
James W. Hall, President

H. J. Happel Company
5501 E. Admiral Blvd.
Tulsa, Oklahoma
Phone: TEmple 5-6058
Harold Happel, President

Harbert Construction Corp.
Box 1369
2208 8th Avenue South
Birmingham, Alabama
Phone: ALpine 1-0256

Harford Brothers
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R. E. Harford, President

A. W. Hartwig, Inc.
301 Fratt Building
Billings, Montana
A. W. Hartwig, President

H & K Construction Company
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Sinton, Texas

Luther G. Harper Construction Co.
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Tulsa, Oklahoma
Phone: Filmore 5-1226
Luther G. Harper, Owner

Harrelson Const. & Welding, Inc.
Skokovat St., Box 432
Seymour, Connecticut
Phone: Tuxedo 8-3353
James C. Harrelson, President

Henson Construction Company
Box 1205
Cisco, Texas

Henuset Brothers, Ltd.
Box 657
Virden, Manitoba, Canada
Phone: 612
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Hebert Brothers Engineers
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Plaquemine, Louisiana
Phone: 3189
Hiram Hebert
Omer J. Hebert
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A. C. Holder Construction Co., Inc.
1712 East Fifth Street
Box 3297, Whittier Station
Tulsa, Oklahoma

Herman W. Holtzer
P. O. Box 1061
Fort Worth, Texas

Hood Construction Company
8201 South Sorensen Avenue
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Southern Pipe Coating Company

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Box 168
Virden, Illinois
Phone: 5091
Melvin L. Hulcher, President

I

E. A. Irish, Contractor
2944 Gleneden Street
Box 39701, Griffith Station
Los Angeles 39, California
Phone: NOrmandy 3-2127
Wm. E. Irish, President

J

Jackson Pipe Line Construction Co.
Box 455
Clendenin, West Virginia

Lester N. Johnson Company
Box 81
Spokane, Washington
Lester N. Johnson, Owner

Johnson-Western Constructors
2031 E. Belt Street
Box 2588
San Diego 12, California

Roy L. Johnson Construction Co.
Box 484
Eldorado, Kansas
Phone: 1303 or 531
Roy L. Johnson, Owner

Johnston Construction Company
Box 105
Deerfield Beach, Florida
Brooks J. Johnston, Sr., President

J. A. Jones Construction Company
Box 996
Charlotte 1, North Carolina

Joyce Pipeline Company
Route 2
Andover, New York
Phone: 2626 or 3222
James V. Joyce, Owner

W. H. Joyner & Sons, Inc.
501 New York Avenue
New Castle, Indiana
W. H. Joyner, President

K

Kansas Pipeline Company
Garden City, Kansas

B. Keillor Company, Ltd.
53 Middlecrest
Ancaster, Ontario, Canada
Phone: Miller 8-4934
Ben Keillor, President

Kenton Meadows Company, Inc.
Box 518
Gassaway, West Virginia
Phone: Forest 4-5151, 4-5152
Box 6398
Orlando, Florida
Phone: Crestwood 7-3221, 7-3222
Kenton Meadows, Owner

K-F-B Construction Corporation
760 Bester Street (Field Office)
Box 1775
Shreveport, Louisiana
Phone: 2-9424 or 5-2491
F. S. Kelly, Jr., President

KLW Pipe Line Construction Co.
607 State Life Building
Indianapolis 4, Indiana
A. A. Kalo, General Manager

Roy E. Knupp Company
East Highway No. 40 — Box 495
Russell, Kansas
Phone: HUdson 3-3675 or
HUdson 3-4722
Box 251
Great Bend, Kansas
Phone: Gladstone 3-5665
Roy E. Knupp, Owner

Knupp Construction Company
Box 152
Great Bend, Kansas
H. V. Knupp, President

Koller Construction Company
707 Liberty Street
Houma, Louisiana
Roscoe Day

The Kuljian Corporation
1200 North Broad Street
Philadelphia 21, Pennsylvania
Phone: STevenson 2-9000
Harry A. Kuljian, President and
Chairman of Board

L

Laco Pipeline Contractors, Inc.
2120 South Post Oak Road
Box 13096
Houston 19, Texas
Phone: MOhawk 7-6647
W. G. Lewis, President

Lasley Construction Corporation
Box 1465
Hobbs, New Mexico
M. W. Lasley, Owner

Laurel Ridge Construction Co.
234 W. Pittsburgh Street
Greensburg, Pennsylvania
Phone: 8911
R. T. McCartney, President

Limberg Excavating Company
2535 Michigan Road
Port Huron, Michigan
C. E. Limberg, President

I. C. Little Construction Co., Inc.
1108 Fidelity Union Life Bldg.
Dallas 1, Texas
Phone: Riverside 7-5781
I. C. Little, President

Lock Construction Company
2801 Rankin Highway
Box 2776
Midland, Texas
L. H. Lock, President

Lone Star Pipe Line Constrs., Inc.
10301 Shady Trail
Box 13167
Dallas 20, Texas
Phone: Fleetwood 7-2833
Paul R. Halbert, Partner
N. K. McFarland, Partner

Lord Brothers Contractors
9233 N. Calvert Avenue
Portland, Oregon
W. T. Lord, Owner

W. M. Lyles Company
Box 495
Avenal, California
Phone: AVenal 222
W. M. Lyles, President

M

Macco Corporation
14409 South Paramount Blvd.
Paramount, California

Majestic Contractors Limited
408 Royal Trust Building
Edmonton, Alberta, Canada
Phone: 4-1922, 2-7822
W. A. Rose, President

Mannix Company, Ltd.
332 Seventh Avenue West
Calgary, Alberta, Canada
Phone: Calgary-AMherst 6-7361
F. C. Mannix, President

The Marcelletti & Son Constr. Co.
25 W. Monroe Street
Bedford, Ohio
Emil Marcelletti, President

Marine Gathering Company
510 Texas National Bank Bldg.
Houston, Texas
Phone: CA 5-1493
G. Burton Liese, President
R. C. Ledford, VP & Mgr.

Marine Pipeline & Dredging, Ltd.
640 West Hastings Street
Vancouver, B. C., Canada
Phone: TAtlow 8461
G. P. Kennedy, Board Chrm.
D. J. Baldwin,
Pres. & Gen. Mgr.

Mary Construction Company, Inc.
Box 423
Cape Girardeau, Missouri
Phone: EDgewater 5-8204
R. B. Potashnick, President

O. W. Mayfield Contracting Co.
701 N.E. 2nd, Box 663
Andrews, Texas
Phone: LA 3-3322
O. W. Mayfield, Owner

McCutchen Construction Company
1426 Elton Road
Jennings, Louisiana
Phone: 668 and 669
V. B. McCutchen, Owner

McKenzie Construction Co., Inc.
Box 301
134 East Water Street
Lock Haven, Pennsylvania
C. H. Basker, Jr., Sec'y. & Treas.

Henry C. McDonald Company
Box 1032
Kilgore, Texas
H. C. McDonald, President

W. K. McIlyar Construction Co.
8505 Douglas Street
Dallas, Texas
Phone: Em 1-2273
W. K. McIlyar, Owner

McLaughlin, Inc.
Box 1824
Great Falls, Montana
J. L. McLaughlin, President

McVean and Barlow, Inc.
Box 151
Odessa, Texas
Phone: FE 7-2377
A. A. McVean, Board Chrmn.
K. K. Barlow, President

Meadows Southern Const. Co.
Box 6398
Orlando, Florida
Phone: Crestwood 7-3221, 7-3222
Kenton Meadows, Owner

John Meehan and Son
916 West Dakota St.
Philadelphia, Pennsylvania

John Meents Construction Co.
630 N. E. Military Hwy.
San Antonio 12, Texas
John Meents, Owner

Mermis Construction Company
Box 1017
Artesia, New Mexico
Phone: SHerwood 6-2852
Alfred Mermis, Owner

M. G. M. Construction Company
Box 1056
Concord, California

Mid-Mountain Contractors, Inc.
1310 Airport Way
Seattle, Washington
Phone: MUtual 2146
F. E. Everett, Jr., President

Mid-States Construction Company
Box 417
Mt. Vernon, Illinois
Phone: 5245
O. A. Holdren, President

Midwestern Constructors, Inc.
105 North Boulder
Tulsa 3, Oklahoma
Phone: Diamond 3-4113
F. E. Stanley, President

Midwestern Contractors, Inc.
130 West Liberty Drive
Wheaton, Illinois
Phone: WHeaton 8-3420
A. T. Everham, President

Miller Brothers, Contractors
3302 So. 4th St.
Abilene, Texas
Phone: ORchard 4-7932
L. C. Miller, Partner
V. E. Miller, Partner
J. W. Miller, Partner

Don W. Miller, Inc.
211 Euclid Street
Green Springs, Ohio
Phone: 3061
Don W. Miller, President

Russ Mitchell, Inc.
Box 8068
5304 Old Spanish Trail
Houston, Texas
Phone: OLive 4-2681
Raymond Wise, President

Mitchell Construction Company
301 West 53rd Street North
Wichita, Kansas
Phone: TEmple 8-6141
Vernon E. Mitchell, President

Roy M. Mitchell Contracting Co.
2120 W. Erwin Street
Tyler, Texas
Roy M. Mitchell, Owner

Mitchell Darby Construction Co.
610 E. Beaumont St.
Box 169
McAllen, Texas
Phone: MU 6-2463, 2464
Mitchell Darby, Owner

M & N Construction Company
Box 12306
8406 Mosley
Houston, Texas
Phone: HUdson 6-7751
J. D. Nipper, President

Modern Constructors
425 Lake Ave. S.
Duluth, Minnesota
Paul W. Miller

Modern Welding Company
1500 East Twelfth Street
Box 528
Owensboro, Kentucky
Phone: MUrray 3-5323
Wesley Embry, Mgr. P/L Div.

Moon & Sons
Box 753
Connelsville, Pennsylvania
Fred R. Moon, President

Charlie Moore
Box 11682
Dallas, Texas

M. L. Jack Moore
Box 1444
Odessa, Texas

Gerald Mora
Box 2623
Houston, Texas
Phone: HUdson 6-7158

W. D. Morgan & Son
Ladysmith, Wisconsin
W. D. Morgan, President

Morrison Construction Co., Inc.
1834 Summer Street
Hammond, Indiana
Phones: Hammond, Indiana,
WEstmore 2-5036
Chicago, Illinois, SAginaw 1-7036
J. M. Morrison, President

Morrison-Knudsen Company, Inc.
319 Broadway
Boise, Idaho
Phone: 4-3521
H. W. Morrison,
President and Board Chairman

M-R Company
5317 W. Harry St.
Box 484
Wichita 1, Kansas
Phone: WHitehall 3-7951
Myrl Rumsey, Owner

P. L. Murphy Construction Co.
128 East Main Street
Dwight, Illinois
P. L. Murphy, President

Bill Murry and Company
2495 Gulf Street
Beaumont, Texas
Phone: TErminal 5-6372
Bill Murry, President

N

Narramore Construction Company
Drawer 38
Maysville, Oklahoma
Phone: 7-4444
Marvin Narramore, Owner

J. P. Neill & Company
Meadows Bldg.
Dallas 6, Texas
Phone: FO 8-5939
James P. Neill, President

L. F. Nichols Construction Co.
Box 376
Great Bend, Kansas
Phone: GLadstone 3-5772
L. F. Nichols, Owner

H. H. Null Pipeline Contractors
215 Lockwood Drive
Houston 11, Texas

O

O'Connor Construction Company
Fromberg, Montana
Phone: 6500
Geo. W. O'Connor

Odegard Construction Company
2110 37th Street
Everett, Washington

Ohio Pipe Line Construction Co.
1635 West Church Street
Box 29
Newark, Ohio
Phone: Diamond 4-4125,
Diamond 4-3535
O. H. Ralston, President

Ohio Pipe Line Constr. Co., Inc.
607 State Life Bldg.
Indianapolis 4, Indiana
Albert A. Kalo, President

Oklahoma Pipe Line Constructors
6612 Harry Hines Boulevard
Dallas, Texas
Box 13227
Phone: FLeetwood 1-3711
T. A. Hester, Managing Partner
M. W. Staples, Managing Partner
R. J. O'Connell, Managing Partner

F. S. Oldt Company
403 S. Haskell Avenue
Dallas, Texas
Phone: TA 4-6761
F. S. Oldt, Owner

Oliphant Construction Company
1612 South Street
Lafayette, Indiana
D. A. Oliphant, President

Oman Construction Co., Inc.
Box 146
Nashville, Tennessee
Phone: AMherst 9-5601
Stirton Oman, Chairman of Board
John Oman III, President

Otis Eastern Service, Inc.
343 Main Street
Bolivar, New York
Phone: 690
John A. Thompson, President

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P

Pacific Pipe Line Con. (Alberta) Ltd.
301 Northern Hardware Building
Edmonton, Alberta, Canada

Pacific Pipeline Construction Co.
1632 South Greenwood Avenue
Montebello, California

Panama, Inc.
2201 Commerce Building
Houston 2, Texas
Phone: FAirfax 3-2277
R. G. Rice, President

Panama Williams Corporation
1418 Melrose Bldg.
Houston, Texas
Phone: CApitol 5-3507
M. S. Williams, President

Patterson & Ford Construction Co.
2717 31st Ave. No.
Birmingham, Alabama
John D. Ford, President

Pavilion Pipe Line Corp.
Box 126
Leroy, New York
R L. White, President

A. T. Perry Pipe Line Constr., Inc.
353 East 69 Highway, Route 5
Kansas City 17, Missouri
A. T. Perry, President

Pierce Construction Company
Box 3115
Tulsa, Oklahoma

Pioneer Construction Company
1300 Oak Street
Chattanooga, Tennessee

Pipe Line Const. & Drlg. Co.
Box 165
301 Market Street
Lemoyne, Pennsylvania

Pipe Line Maint. & Constr. Co., Inc.
Box 56
Camp Hill, Pennsylvania

Pipeline Service Company
540 West Strother
Box 32
Seminole, Oklahoma

Pipeline Welding & Constr. Co.
150 Washington Avenue
Carteret, New Jersey
Phone: KImball 1-4330
KImball 1-4354
John C. Worthy, President

Pitts & Bryant Company, Inc.
Box 432
Clarksville, Arkansas
Phone: 795
R. E. Pitts, V-P and Gen. Mgr.

P & M Construction Company
361 Dickman Road
Battle Creek, Michigan

Poole Construction Company, Ltd.
Rivers, Manitoba, Canada

Poston Corporations
621-622 Metropolitan Bldg.
Akron 8, Ohio
Phone: JEfferson 5-1915, 5-4749
Jack O. Poston, President

R. B. Potashnick
Box 423
Cape Girardeau, Missouri
Phone: EDgewater 5-8204
R. B. Potashnick, Owner

Prairie Construction Company
Box 1526
Lubbock, Texas

H. C. Price Company
Price Tower
Bartlesville, Oklahoma
Phone: 4700
H. C. Price, President

Ted Price Construction Company
Box 72
Electra, Texas
Ted Price, President

R

Steve P. Rados Company
112 W. Maple Street
Monrovia, California

Ramey Contracting Co., Inc.
Box 182
1215 No. Alder
Bellaire, Texas
Phone: MOhawk 7-2143
Roy A. Ramey, Owner

Ransdell Construction Company
270 Meadows Building
Dallas, Texas
Phone: EM 8-2817
R. E. Ransdell, Owner

W. L. Rea Construction Co.
401 Westchester Drive
Corpus Christi, Texas
W. L. Rea, Owner

Reason Construction Company
3045 W. Liberty Avenue
Pittsburgh 16, Pennsylvania

John T. Reed Contracting Co., Inc.
Box 192
East Tupelo, Mississippi
Phone: VI 2-5336, VI 2-7936
J. T. Reed, Owner & Pres.

E. H. Reeder Construction Co.
2128 Hawes Avenue
Dallas, Texas
Phone: FL 2-2605
J. A. Reeder

Reilly-Bates Corporation
212 N. E. First Avenue
Pompano Beach, Florida
Phone: WEbster 3-7913

Rich Construction Company
Box 197
Bradford, Pennsylvania

River Construction Corporation
4837 West Freeway
Box 9127
Fort Worth 7, Texas
Phone: PErshing 8-6518
Robt. Thomas, VP & Gen. Mgr.

Alex Robertson Company
14433 South Paramount Blvd.
Box 757
Paramount, California
Phone: NEvada 6-1225,
MEtcalf 3-1191
Alex Robertson, President

C. L. Rogers Construction Co., Inc.
1114 City National Bldg.
Box 1706
Wichita Falls, Texas

Nat C. Rose & Son Const. Corp.
3200 Lawndale Street
Endicott, New York
Walter C. Rose, President

Rosendahl Corporation
11933 Wilshire Blvd.
Los Angeles 25, California
Phone: GRanite 9-3775
Van W. Rosendahl, Chairman of Board
Milton O. Rosendahl, Pres.

Ross-Powers Construction Co.
1131 North Thirtieth Street
Box 2038
Billings, Montana
Phone: 9-2038
Grady T. Ross, Partner

S

N. A. Saigh Company
Suite 531, Majestic Building
San Antonio 5, Texas
Phone: CApitol 5-2933
N. A. Saigh, Owner

O. G. Sanders & Son Contractors
Box 3176
Waco, Texas

S E Pipe Line Const. (Alberta) Ltd.
10201 - 104 Street
Edmonton, Alberta, Canada
Phone: 4-4607
H. C. Dickinson, President

The Shaffer Company
1312 Sycamore Street
Waterloo, Iowa
C. H. Shaffer, Co-owner
James C. Cox, Co-owner

Shamrock Construction Company
307 Mutual Bldg.
Lansing, Michigan

Sharman, Allen, Gay & Taylor, Inc.
3115 Buffalo Drive
Houston, Texas
Phone: JAckson 6-1841
J. W. Sharman, President

Shawver and Hailey
Box 1127
Maud, Oklahoma

F. E. Shaw, Ltd.
530 South Vidal Street
Sarnia, Ontario, Canada
Phone: DIgby 4-2416
F. E. Shaw, President

Sheehan Pipe Line Construction Co.
514 Natl. Bank of Tulsa Bldg.
Tulsa, Oklahoma
R. D. Sheehan, Mng. Partner

Sheppard-Geiger Construction Co.
Box 2098
Corpus Christi, Texas

F. L. Showalter, Inc.
2900 Fulks St.
Lynchburg, Virginia
Phone: 2-2388
F. L. Showalter, Sr., President

Charles Simkin & Sons, Inc.
95 New Brunswick Avenue
Hollelawn, New Jersey
Charles Simkin, President

Ben Sira & Company
Box 11645
17[illegible]0 John West Road
Dallas, Texas
Phone: DA 7-4511
B. H. Bishop, President

Slade & McElroy, Inc.
2105 25th Avenue
Box 255
Gulfport, Mississippi
Phone: UNiversity 3-4022
Preston Slade, President

Carl E. Smith, Inc.
Box 4
Sandyville, West Virginia
Phone: Ravenswood
Browning 3-4261
Carl E. Smith, President

Smith Contracting Corporation
R. F. D. No. 6, Box 211
Fort Worth, Texas
Phone: VInewood 2113
O. R. Smith, President

Snelling Company
La. Highway No. 1 and Old Pine Hill Road
Shreveport, Louisiana
Phone: 2-8731
J. F. Snelling, Co-owner
W. D. Snelling, Co-owner

Sollars Contracting Company
817 W. Green St
Hastings, Michigan
A. K. Sollars, Owner

Somerville Construction Company
6648 Fulton Road
Ada, Michigan
Phone: ORiole 6-4611
R. B. Somerville, President

Robert B. Somerville Co., Ltd.
4126 Bathurst
Toronto, Ontario, Canada
Phone: Melrose 3-4264
Robert B. Somerville, President

P. C. Sorenson Company
Box 4093
2207 So. Industrial Blvd.
Dallas, Texas
Phone: HA 1-9724
H. V. Sorenson, President

Southeastern Contracting Co.
Box 9068
Birmingham, Alabama
W. P. Cox, Jr., Partner
J. T. Cox, Partner
James L. Cox, Partner
R. L. Cox, Partner

Sterling Construction Company
Box 1186
Sterling, Colorado

Stone & Webber Const. Co., Inc.
Box 550
Salem, Virginia
Phone: DU 9-2421

Stuart Pipe Line Construction Co.
Box 790
Beeville, Texas
Phone: FL 8-1515
Burley Stuart, Owner

Sullivan, Long & Hagerty
2028 Second Avenue
Bessemer, Alabama
Phone: HA 8-2355
Charles A. Long, Sr., President

Sweazy Construction Company
Box 565
Ulysses, Kansas
Phone: FLanders 6-1610, 6-1630
Fred M. Sweazy, Partner
J. H. Moore, Jr., Partner

Swilling & Boyd Contractors
Box 96
Whitney, Texas
R. T. Swilling, Jr., President

T

L. W. Tarnow Pipeline Company
Box 96
Kansas, Illinois
Phone: YE 8-2031
N. M. Tarnow, Owner

Texas Engineering & Const. Co.
723 North Grand
Box 1203
Amarillo, Texas
Phone: DR 2-1325

Texas-Louisiana Contractors
Box 9127
Fort Worth 7, Texas
Phone: PErshing 8-6518
Robert Thomas, Partner

Thorn & Marble Company
4225 23rd Avenue, West
Seattle 99, Washington

Joe Titsworth
Box 1539
Kilgore, Texas

Trojan Construction Co., Inc.
Suite 200, 1416 North Robinson
Oklahoma City 3, Oklahoma
Phone: CEntral 2-7466
Felix M. Johnson, President

Troth Construction Company
Box 592
Britton, Oklahoma

T. T. Construction Company
Box 817
Tomball, Texas
Phones: 484, 485
T. T. Moore, President

Tulsa Contracting Co., Inc.
953 Warren Avenue
East Providence, Rhode Island

U

Underground Constructors, Inc.
Dodge Center, Minnesota
Phone: 2431
W. C. Donaldson, Partner
D. J. Ludlum, Partner

Union Construction Company
Box 57
Sturgis, Kentucky
Phone: 3542
I. C. Russell, Jr., President

United Pipe Line Contractors, Inc.
Box 839
Beloit, Wisconsin
Phone: EMerson 2-7060
EMerson 5-3596
Eugene Alters, President

Utility Builders, Inc.
432 Ford Bldg.
Box 1154
Great Falls, Montana
Phone: GL 2-3448, 2-5311
E. H. Blakeslee, President

Utility Construction Company
9830 Atlantic Avenue
South Gate, California

V

Valley — M-K Company
7722 Rainier Avenue
Seattle, Washington

Vaughn & Taylor Const. Co., Inc.
2103 North Grant
Box 2624
Odessa, Texas
D. D. Vaughn, President

Vedal Pipe Line Construction Co.
Rt. 5 Salem Road
Mount Vernon, Illinois
Phone: 4400
E. C. Veach, President

Ventura Pipeline Construction Co.
899 North Olive Street
Box 1252
Ventura, California

Virginia Pipe Line Const. Corp.
Box 156
Hampton, Virginia

E. Voigt Company, Inc.
12 S. 7th St.
Perry, Oklahoma
Phone: 169
E. F. Voigt, President

W

Karl B. Wagner Engr. Constr., Inc.
Box 4116
Austin, Texas
Karl B. Wagner, Owner

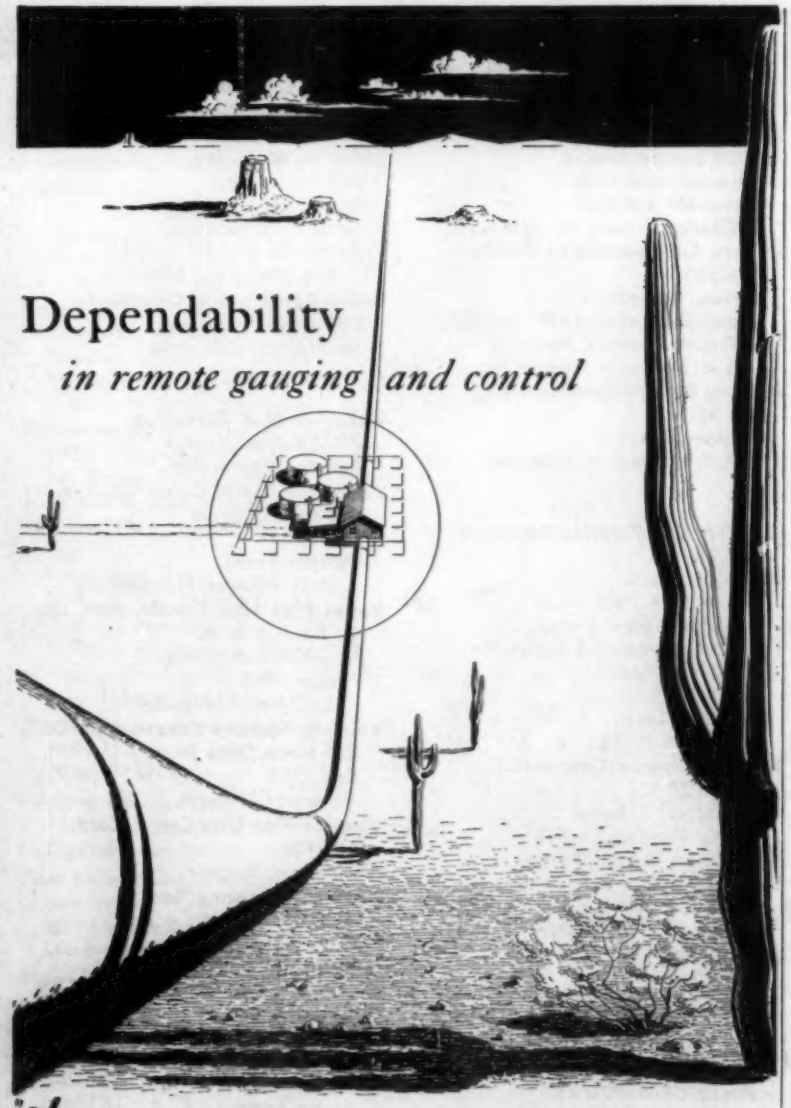
James Watt, Inc.
111 Teall Avenue
Syracuse 3, New York
Phone: GRanite 2-1291
James B. Watt, Owner

L. E. Webb Construction Co., Inc.
Box 705
Santa Maria, California

Welded Construction Co., Inc.
Rosebush, Michigan
Phone: GEneral 3-2281
Harold U. Fluharty, President

Western Construction Co.
Meadows Building
Dallas, Texas
Phone: EMerson 8-3621
James P. Neill, President

Western Pipe Line, Inc.
Box 1076
Austin, Texas
Phone: GR 7-9487
E. G. Morrison, President



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Cable address: Varec Compton Calif (U.S.A.) All Codes
961-24

Contractors Directory

M. E. White Construction Co.
715 W. Woodside Street
Box 441
McPherson, Kansas
Phone: 261
M. E. White, Owner

White Ditching Co., Inc., of Wyo.
Box 39
Casper, Wyoming
Phone: 3-3783
H. H. Hayman, President

Norton E. White, Inc.
5920 Long Drive
Houston, Texas
Phone: MIssion 9-2781
Norton E. White, Owner

Jess Whitlow Pipe Line Service
Box 1844
Ponca City, Oklahoma

Whittle Construction Co.
Box 5602
4007 Irving Blvd.
Dallas, Texas
Phone: FL 1-5383
R. D. Whittle, President

Williams-Austin Company
3322 Grant Building
Pittsburgh 19, Pennsylvania
Phone: ATlantic 1-8170
G. A. Manuel, President

Williams Brothers Company
326 National Bank of Tulsa Bldg.
Tulsa 3, Oklahoma
Phone: LUther 5-9161
John H. Williams, President

C. E. Wilson Construction Co.
1401 Fairfax Trafficway
Kansas City 15, Kansas
Phone: FAirfax 1-6287
C. E. Wilson, Owner

J. L. Williams Construction Co.
Box 164
6114 Edgemoor
Bellaire, Texas
Phone: GYpsy 4-2574
J. L. Williams, Owner

Cole Williams, Inc.
Box 4625
7903 Manderville Lane
Dallas, Texas
Phone: EM 1-1753
W. B. Williams, President

Winger Construction Company
1200 East Main Street
Ottumwa, Iowa

Wirt & Starn, Inc.
736 W. Liberty Street
Wooster, Ohio
Phone: ANgelus 3-4731
Paul Wirt, President

Wonderly Construction Company
2694 Lime Avenue
Long Beach 6, California
Phone: GArfield 7-8945,
NEvada 6-3184
M. C. Wonderly, President

Wyoming Ditching Service
123 Winthrop
New Castle, Wyoming
Phone: SHerwood 6-4297

FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

Y

J. E. Young Pipe Line Contr., Inc.
9[illegible] East Rosecrans Avenue
Los Angeles 2, California
Phone: NEvada 6-2293
J. E. Young, President

L. R. Young Construction Co.
Box 372
Salem Natl. Bank Bldg.
Salem, Illinois
Phone: SAlem 193

Z

H. B. Zachry Company
Pipe Line Department
Box 10188
San Antonio 21, Texas
Phone: WAlnut 2-1213
K. A. Ervin, Dept. Mgr.

Specialized Contractors

Listed below are names, addresses, and chief contact of those firms doing specialized contract services such as coating and wrapping, river crossings, marine pipeline construction, X-ray inspection, etc.

A

Abrams Aerial Survey Corporation
606 East Shiawassee
Lansing 1, Michigan
Ralph E. Kauffman, President
Aerial Surveys

Aero Service Corp. (Mid-Continent)
1401 South Detroit
Tulsa, Oklahoma
Aerial Surveys

American Dewatering Corporation
140 Cedar Street
New York, New York
S. P. Edgar, General Supt.
River Crossing Dewatering
Dewatering Wet Soil

American Pipe Coating Contr., Inc.
Box 89
Jennings, Louisiana
Phone: 2599
Lewis A. Wheeler, Jr., President
Coating and Wrapping
Reconditioning and Beveling
Railhead Jobs

Asbury Transportation Company
2222 East 38th Street
Los Angeles 58, California
Phone: Adam 4-9261
5303 Rosedale Highway
Bakersfield, California
Phone: Fairview 7-2271
Hauling

Atlantic Gulf & Pacific Company
15 Park Row
New York 38, New York
Phone: Barclay 7-8370
H. F. Schoon, President
Marine Dredging

B

C. F. Bean, Contractor
Box 335
Plaquemine, Louisiana
C. F. Bean, President
Marine Dredging

George J. Beemsterboer, Inc.
3500 Canal Street
East Chicago, Indiana
or 11732 Yale Avenue
Chicago 28, Illinois
George J. Beemsterboer, Pres.
Ditching and Excavating
Right-of-Way Clearing/Grading

Bell Transportation Company
1406 Hays
Houston, Texas
Phone: FAirfax 3-4361
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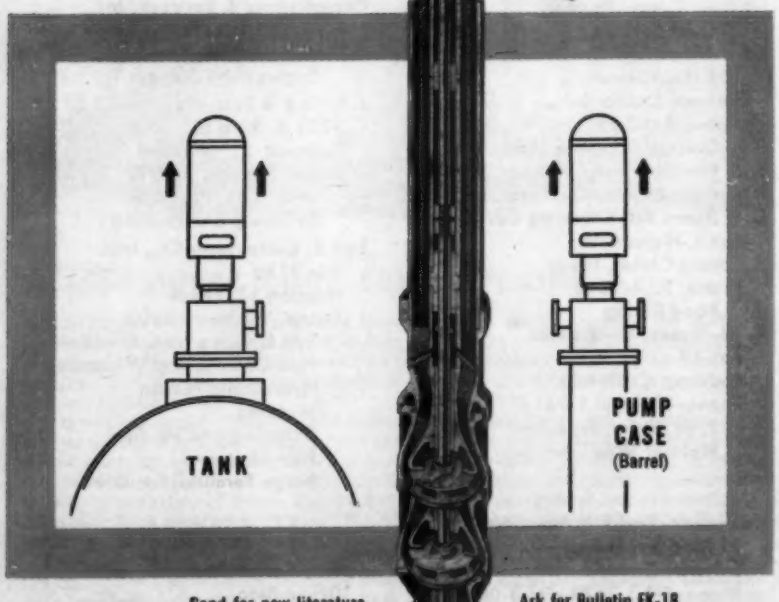

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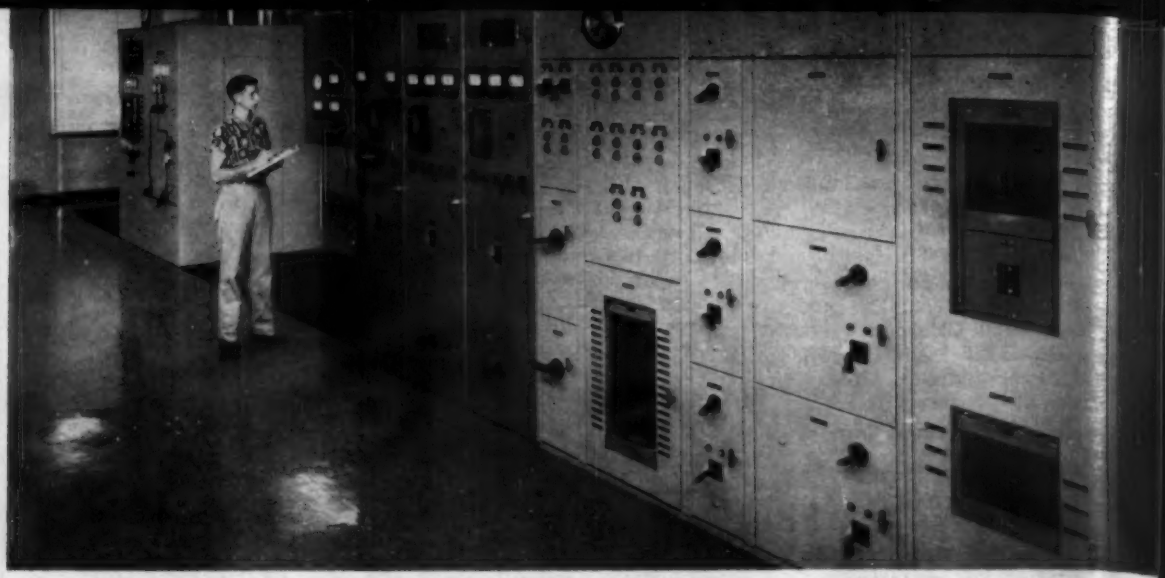

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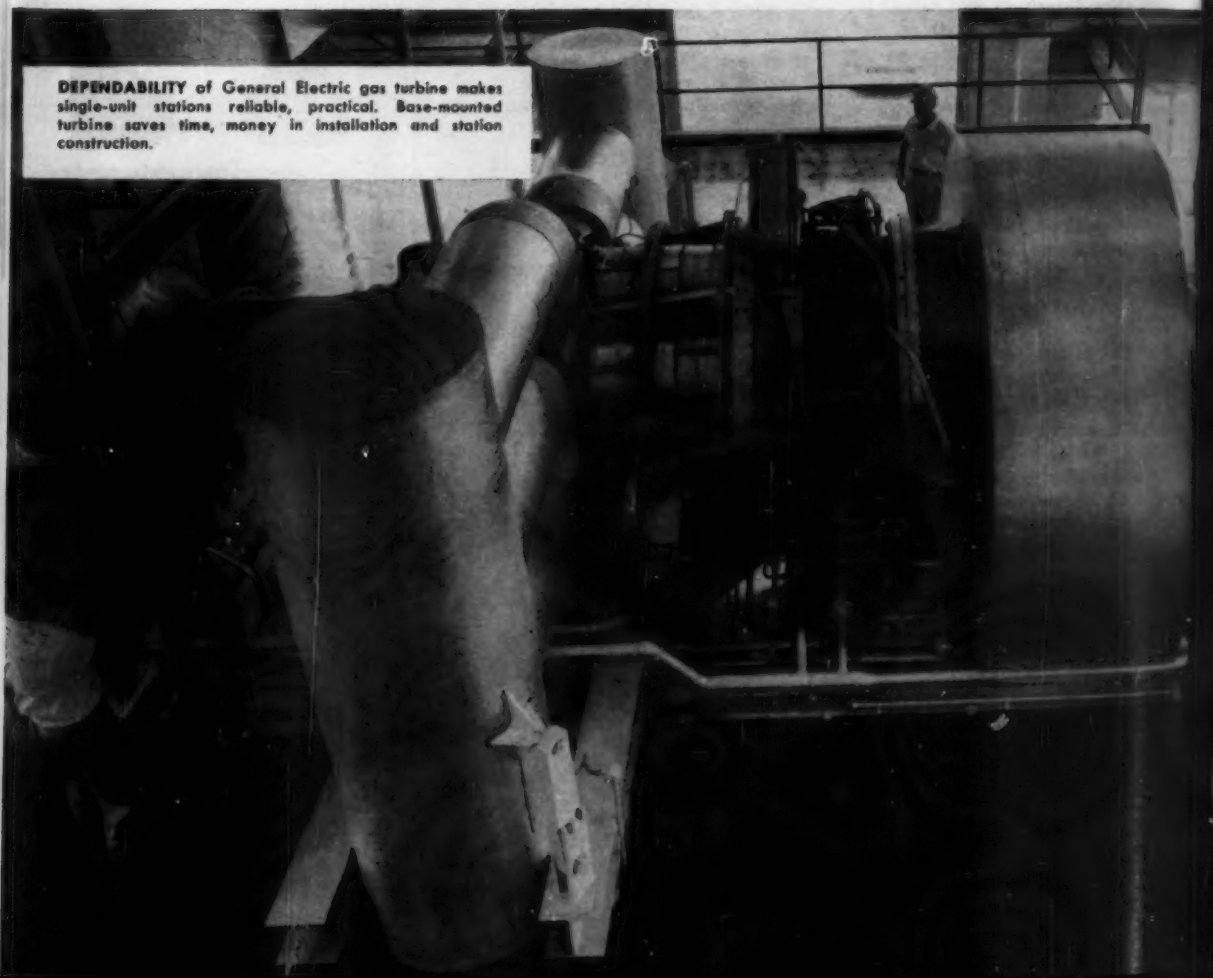

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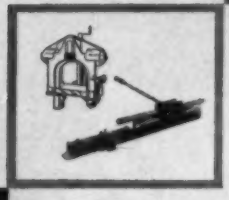

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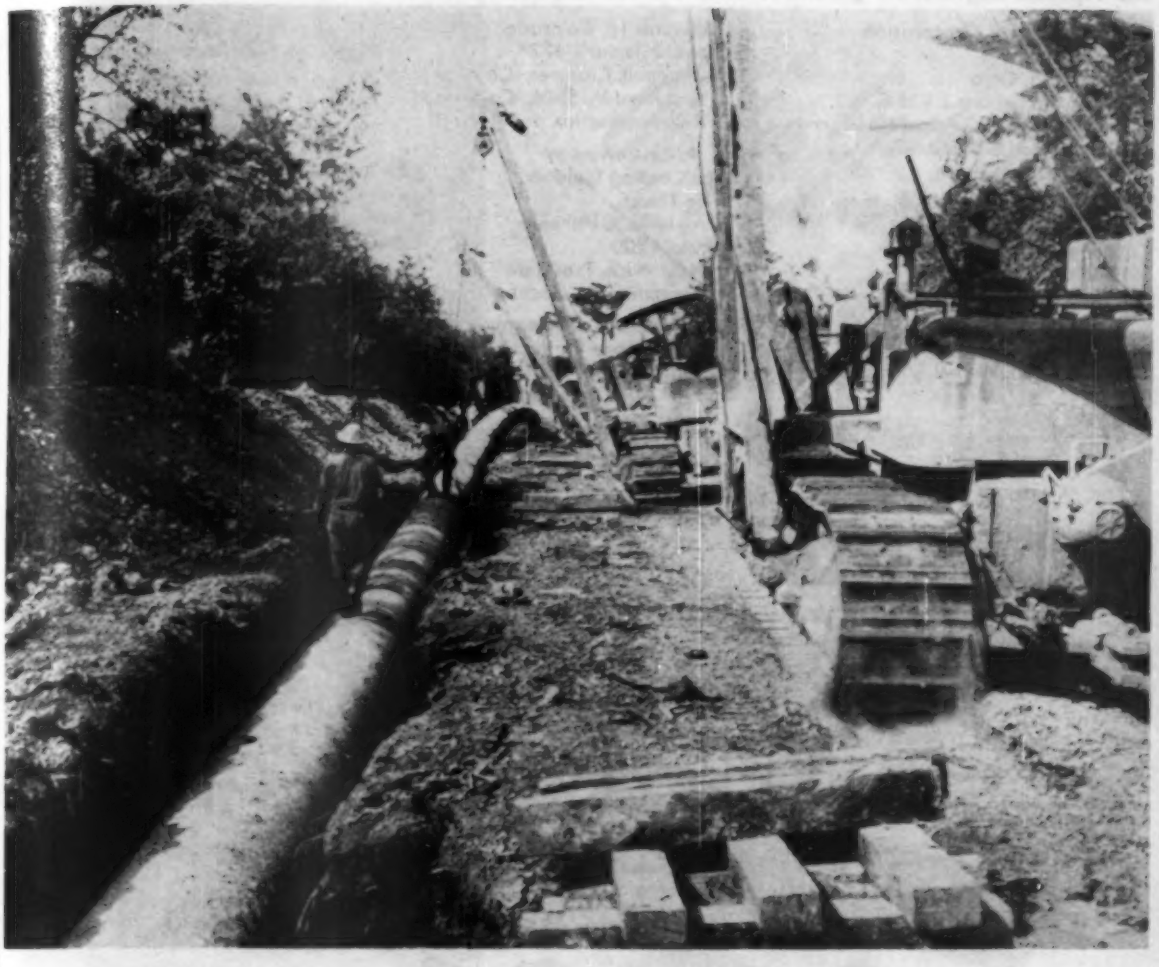

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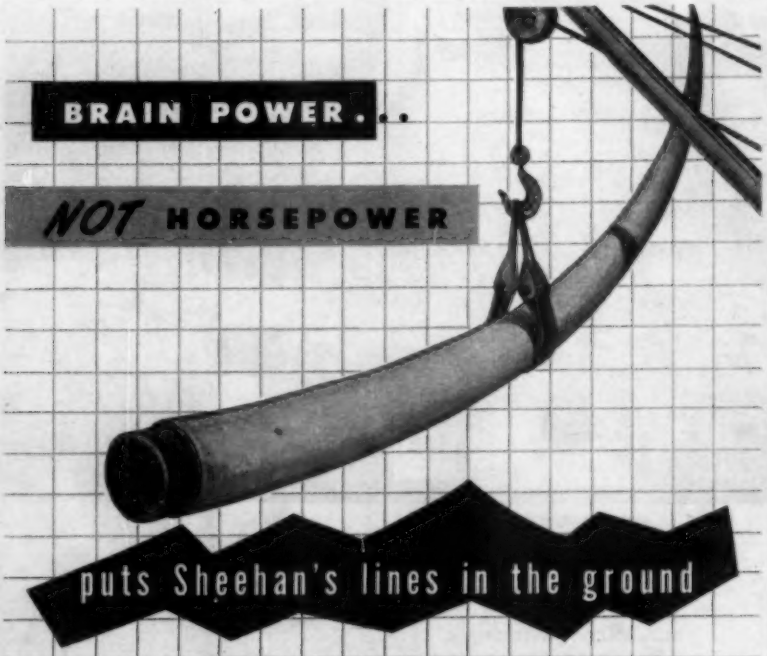

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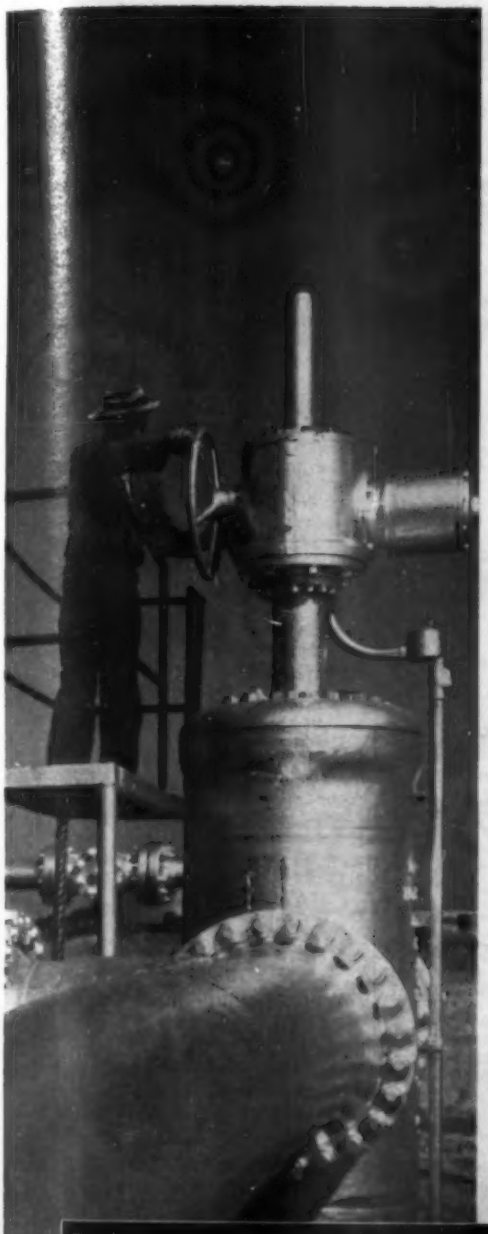

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The operator has complete control of the sealing action of W-K-M Parallel Expanding Gate Valves. Sealing is not dependent on either the line pressure or on stress wedging the gate in the valve.

When the W-K-M Valve gate unit reaches the full open or closed position, the torque applied by the operator through the stem forces the gate and segment to expand against the seats to form a perfect seal, upstream and downstream. CONTROLLED FORCE SEATING is completely independent of outside factors. Neither high nor low pressure nor line pressure fluctuation has any effect on the seal of W-K-M Valves.

When the valve is being opened or closed the CONTROLLED FORCE SEATING action is released and the gate unit is held in a collapsed position. This provides a slight clearance between the faces of the gate and the seating rings, allowing the gate to move freely.

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For design and operating features, sizes, pressures and complete dimensions, write Dept. G-1 for Through-Conduit Gate Valve Catalog 300.

5716

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The Pipeline Engineer's Pipeline Contractors Directory . . .

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90 Broad Street
New York, New York
Engineering Services

Stout Construction Co., Inc.
Hurricane, West Virginia
Phone: Hurricane 4091
Richard B. Stout, President
Patrol and Maintenance

St. Paul Dredging Company
1397 Laurel Avenue
St. Paul 4, Minnesota
H. P. Phelps, President
River Crossings
Dredging

Stramler & Miller
1210 Dunlavy Street
Houston, Texas
Engineering

T

Tellepsen Petro-Chem Constructors
(Div. of Tellepsen Construction Co.)
1710 Telephone Road
Houston, Texas
Phone: WA 3-9331
Emory E. Gose, Jr., Vice Pres.
Ditching and Excavating
Marine Dredging
Engineering Services

Tinker & Rasor
417 Agostino Road
San Gabriel, California
Phone: ATlantic 7-7942
John Rasor, President
Holiday Inspection

Tuloma Builders, Inc.
8500 East 41st Street
P. O. Box 7036
Tulsa, Oklahoma
Phone: RI 7-1311
Clyde Wyant, President
Engineering Services
Fabrication
Station Construction

U

United Engineers & Constrs., Inc.
1401 Arch Street
Box 628
Philadelphia 5, Pennsylvania
C. A. Schlegel, Jr., Vice Pres.
Engineering Services

W

Leroy L. Wade & Son, Inc.
1615 Izard Street
Omaha 2, Nebraska
Phone: Webster 0600
Leroy L. Wade, President

Walco Engineering & Const. Co.
2408 East 4th Place
Box 3037, Whittier Station
Tulsa, Oklahoma
Phone: MAdison 6-2136
Paul C. Wallack, President
Engineering Services
Pipeline Construction
Station Construction

Walnesco, Inc.
1610 First National Bank Bldg.
Dallas 2, Texas
Phone: Riverside 7-7202
Don L. McCarty, President
Hydrostatic Testing

Ward Construction Company
San Antonio, Texas
Marine Terminals

J. C. "Red" Willett
Box 2836
Monroe, Louisiana
Phone: 8201
J. C. "Red" Willett, President
Stringing

Williams Pressure Service Co.
2000 Henry C. Beck Bldg.
Shreveport, Louisiana
Hydrostatic Testing

Fabrication
Marine Pipe Line Construction
Station Construction

Edgar Tobin Aerial Surveys
Box 2101
San Antonio 6, Texas
Phone: CApitol 3-6203
R. L. B. Tobin, General Manager
Aerial Surveys

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HOUSTON 6, TEXAS

WITH THE PIPELINE CONTRACTORS

● **Fulton Banister, Ltd., 625 Northern Hardware Building, Edmonton, Alberta.** Has 100 miles of 18-in. for *Alberta Gas Trunk Line Company, Ltd.*, from Burstall at the Alberta border to Provost, Alberta. Also has 22 miles of gas gathering line in the Provost field for *Provo Gas Producers, Ltd.*, consisting of constructing gathering system and wellhead tie-ins—3 to 12-in. pipe; this gas to be fed to Alberta Gas Trunk Lines.

● **Banister Construction, Ltd., 625 Northern Hardware Bldg., Edmonton, Alberta.** Has undetermined amount of 2 to 6-in. extensions to existing systems in cities and towns in Saskatchewan, plus approximately 5000 consumer service connections, for *Saskatchewan Power Corporation*. Has contract for construction of transmission and distribution system in the town of Wilkie, Saskatchewan, for the *Saskatchewan Power Corporation*.

● **F. E. Shaw, Ltd., 530 S. Vidal Street, Sarnia, Ontario.** Has 40 miles of 6 to 10-in. line for *Dominion Natural Gas Company, Ltd.*, in the Brantford, St. Catharines, and St. Thomas districts. Has 8 miles of 16-in. line for *Dow Chemical of Canada, Ltd.*, from new salt bed location to the Sarnia district. Has 14 miles of 16-in. loop line around the city of Hamilton, Ontario, for *United Gas and Fuel Company*. Has 67 miles of 6 to 20-in. transmission lines for *Union Gas Company*, Chatam, Ontario, to Dawn, London, St. Marys, Stratford, Kitchener and Guelph.

● **Williams Brothers Company, National Bank of Tulsa Bldg., Tulsa, Oklahoma.** Has 212.5 miles 20-in. crude line for *Socony Mobil Oil Company de Venezuela*. Line will extend from San Silvestre field to Puerto Cabello on the Caribbean Coast.

● **Sheehan Pipe Line Construction Company, National Bank of Tulsa Bldg., Tulsa, Oklahoma.** Has 116 miles of 8-in. line for *Buckeye Pipe Line Company* between Huntington and Griffith, Indiana; project includes take-up, reconditioning and relay. Also has 70 miles of 8-in. line to recondition for *Buckeye Pipeline Company* near Cooks Ferry, Ohio.

● **Troth Construction Company, Box 592, Britton, Oklahoma.** Has contract for 160 miles of 2 and 8-in. lines for gas distribution to communities in the Aberdeen, South Dakota, area, for *Northern Natural Gas Company*.

● **Canadian River Construction, 580 Hornby Street, Vancouver, British Columbia.** Has 150 miles of gathering lines in northern Alberta and British Columbia for *Westcoast Transmission Company, Ltd.* Also has contract on Spread Y, containing 91.3 miles of 30-in. gas line from Longlac to MP 584.8 at the east bank of the Shekak River for *Northern Ontario Pipe Line Crown Corporation*.

● **Engineers Limited Pipeline Company, 200 Bush Street, San Francisco, California.** Has line for *Pacific Gas & Electric Company* consisting of 37 miles of 20-in., 37 miles of 18-in., and 19 miles of 12-in. to lay from Beehive Bend field to Sacramento, California.

● **Mannix Company, Ltd., 332 Seventh Avenue W., Calgary, Alberta.** Has 160 miles of 3 and 6-in. gathering line to lay in the Pembina field for *Pembina Pipeline, Ltd.* Has contract to lay 12 miles of 4-in. gathering line in the Drumkeller East field for *Pembina Pipeline*. Has four Gunite river crossings on the North Thompson River at Gosnell and Blue River, British Columbia, for *Trans Mountain Pipe Line Company, Ltd.* Also has Spread Z of the second stage of the 30-in. gas line of *Northern Ontario Pipe Line Crown Corporation;* it extends 92.9 miles between the Shekak River and the Kapuskasing River at MP 677.7.

● **Williams-Austin Construction Corporation, 3322 Grant Building, Pittsburgh 19, Pennsylvania.** Has 50 miles of 10-in. for *Central Hudson Gas & Electric Company* between Kingston and Albany, New York. Also has 5.7 miles of 26-in. line for *Atlantic Seaboard Corporation* in Hardy and Grant counties, West Virginia.

● **Dutton-Williams Brothers, Ltd., North Canadian Oil Building, Calgary, Alberta.** Has 60 miles of 30-in. natural gas line from Kenora, Ontario, eastward for *Northern Ontario Pipe Line Crown Corporation*. Has 120 miles of 30-in. line for *Trans-Canada Pipe Line*. Has contract for 80 miles of gathering lines for *Westcoast Transmission Company's* natural gas grid system in the Peace River region; plans call for laying some 20-in. as an extension to the main line and also smaller diameter lines down to 6-in. for the Blueberry field.

● **Fish Service Corporation, M & M Building, Houston, Texas.** Has 67 miles of line for *Florida Pipeline and Storage Company* from Port Everglades to Homestead Air Force Base, Florida.

● **C. P. Bartley & Son Pipe Line Construction, P. O. Box 616, Tioga, North Dakota.** Has 121 miles of 2 through 12-in. gas gathering extensions for *Signal Oil & Gas Company* in the Newton, North Dakota, area.

● **Engineering-Construction Company, First National Bank Building, Tulsa, Oklahoma.** Has contract with *City of Macon, Missouri*, to lay 25 miles of 4 and 6-in. between Moberly and Macon, Missouri, and 12 miles of various size distribution lines in Macon.

● **G.E.T. Construction, Inc., 435 S. 116th St., Milwaukee, Wisconsin.** Has 46 miles of 24-in. loops in Wisconsin and Illinois for *Michigan Wisconsin Pipe Line Company*.

● **Oklahoma Pipe Line Constructors, P. O. Box 13227, Dallas 20, Texas.** Has 35 miles of 30-in. for *Tennessee Gas Transmission Company* between a point in Garrard County, Kentucky, to a point of TGT's compressor site in Powell, Kentucky. Also has 85 miles of 20 and 24-in. (spread 101) of *Trans-Canada Pipe Lines, Ltd.*, on the eastern section, in proximity of Toronto, Ontario, beginning from a point southwest of Toronto circling the city, and also a section beginning at a point east or northeast of Toronto.

● **O. R. Burden Construction Corporation, P. O. Box 5216, Tulsa, Oklahoma.** Has 120 miles of 16-in. and 5 miles of 12-in. for *Magnolia Pipeline Company* from Midland to Abilene, Texas.

● **Price-Poole Pipeline Constructors of Canada (joint venture of H. C. Price of Canada Limited and Poole Construction Company, Ltd.), Rivers, Manitoba.** Has 99-mile section of 34-in. pipe to lay for *Trans-Canada Pipe Line Company* on a section of line in Manitoba Province extending eastward from the Assiniboine River near Miniota.

● **Four Way Company, Farmington Hwy., Aztec, New Mexico.** Has contract to lay 16-in. line for *Texas-New Mexico Pipeline Company*, for a distance of 150 miles southeast from the Aneth field in Southeast Utah.

● **Brown & Root, Inc., 4100 Clinton Drive, Houston, Texas.** Has contract with *Texas Eastern Transmission Corporation* to furnish field supervision for construction of 626 miles of 30-in. loops along the company's line between Beaumont, Texas, and Uniontown, Pennsylvania.

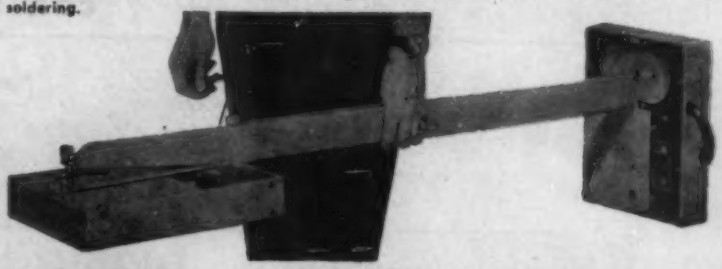
● **Holder Construction Company, Box 1438, Snyder, Texas.** Has contract on 134 miles of 6-in. products line for *Trust Pipe Line Company* between Hawley and Wichita Falls, Texas.

Continued on page D-68

The WILKINSON LINE LOCATOR
PREVENTS COSTLY DAMAGE

Spots all sub surface pipes, cables, etc., and determines their depth accurately.

ETCHED CIRCUITRY: Instead of hand wiring, insures uniformity and freedom from faulty soldering.



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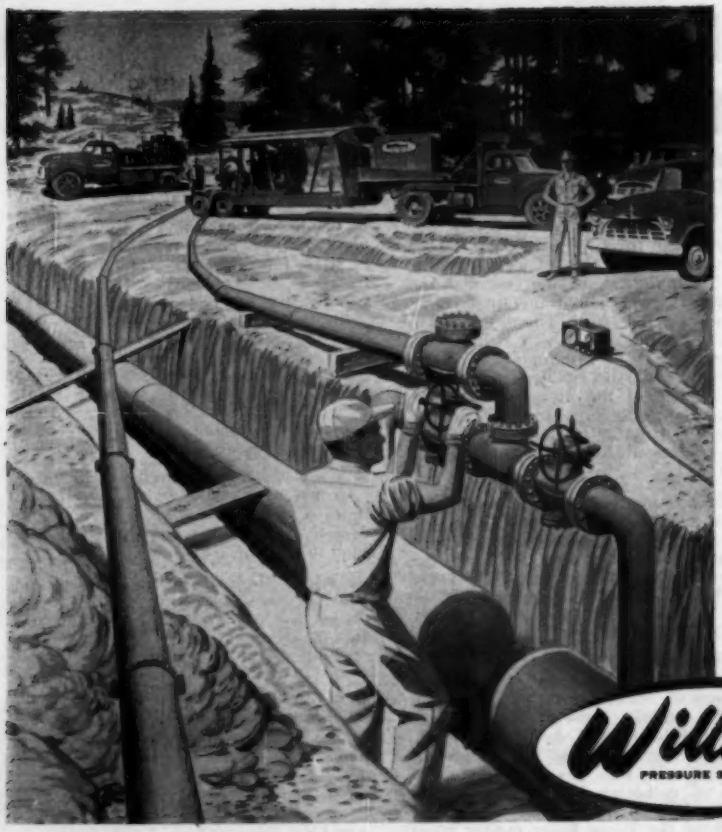

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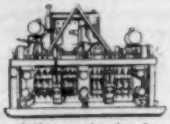
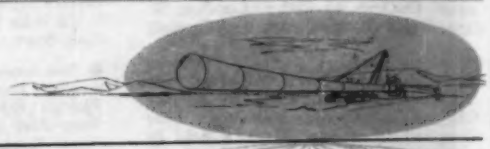

stationary cleaning & priming machine

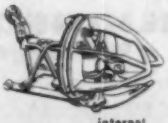


pipeline cradles

pipeline kettles

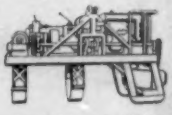
Crose

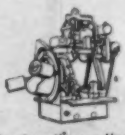
ditch padder


internal line up clamp

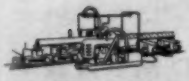
pipeline equipment first choice of contractors everywhere

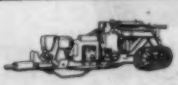
pipe cutting & beveling machine


road boring machine


line traveling coating & wrapping machine

Pipeline construction work — on every continent around the world — goes faster and more economically for hundreds of contractors who depend upon the complete line of Crose equipment. Ruggedly built for top performance anywhere, Crose equipment is available through many strategic supply points.


stationary coating & wrapping machine


Cinch hydraulic pipe bending machine

line traveling cleaning & priming machine

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CONTRACTOR'S NOTEBOOK

OPERATING TRACTORS IN ROCKS IS DIFFERENT

These tips can save you money on maintenance and parts replacement

THE USE of track-type tractors in rock work presents operating conditions and wear characteristics extremely different than those encountered in routine dirt work. Service life of track shoes, rollers, idlers, links, pins, bushings, and final drive sprockets is usually considerably longer in earth operations.

Some owners, whose tractors work in rock operations, do not avail themselves of all the means provided to attain the longest possible service life and the best economic value from their investments. Many owners of track-type tractors, however, have realized through experience that the best way to take on rock work is to prepare to combat the problem of increased depreciation.

Track shoes are the first consideration.

Wide shoes are most satisfactory when flotation is the prime consideration, such as operating in mud, gumbo, etc. It is a known fact that track shoes are more susceptible to breakage where rock is encountered. Wide track shoes have greater "overhang" beyond the track link than narrow shoes, placing more leverage against the outer edge. The result is that wide shoes are more frequently damaged while working in rock than narrow shoes.

The narrower width shoes are best for rock work.

For those specialized operations where a crawler tractor is called upon to work almost exclusively in rock, double grouser track shoes should be used. In addition to offering much better wearing qualities, the second grouser strengthens the shoe longitudinally, providing much greater resistance to bending or cracking under heavy impact in rock work.

Another factor relative to track shoe service life, when operating in rock, is the adjustment of the idler position on tractors that have two-position idlers. When idlers are in the "low" position more rapid track shoe grouser wear will be experienced.

Idlers should be kept in the "low" position only when necessary for the type of job at hand.

A number of attachments are available for track-type tractors and the specific application of the tractor determines those attachments that are most usable and most needed.

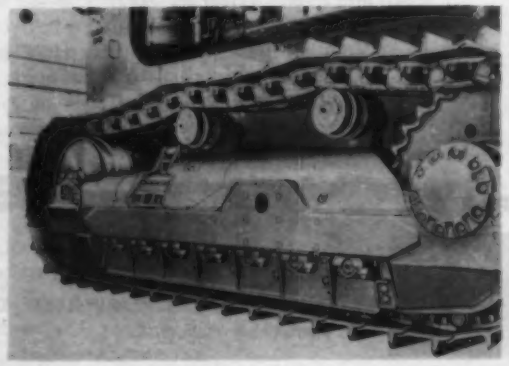
For rock work, the attachment that reduces maintenance cost and parts replacement is the track roller guard group.

According to one manufacturer, Caterpillar Tractor Company, field experience with heavy crawler tractors in rock work has proved quite conclusively that tractor roller guards effectively protect the component parts of the track and provide maximum service life.

For example, on many rock jobs, with identical model tractors working side by side, doing the same type of work, the tractors that were not equipped with track roller guards experienced damage to the component parts of the track. In contrast, very little, if any, damage was experienced on the component parts of the track on the tractors equipped with track roller guards.

Watch the track of a tractor without roller guards when working in rock. Notice what happens, when the tractor works next to a bank or turns in rock.

Extreme rocky conditions of this kind call for special preparation to avoid rapid depreciation to equipment.



Track roller guards shown here are bolted to track roller frame to reduce maintenance and replacement of parts when working in rock.

Rock feeds in between the rollers and the track, and as the tractor moves forward or backward a "rock crushing" action is set up. As the tractor moves backward, rock also feeds in between the idler and the track, and as it moves forward, the rock feeds in between the sprocket and the track. All track components are subjected to unnecessary abrasive and impact damage.

After all, the track group of a tractor wasn't designed to be a rock crusher.

These damaging conditions exist even when the track tension is correctly adjusted, if the tractor is not equipped with track roller guards. Of course, increased wear and damage is far more likely if the track tension is adjusted too tightly. The track recoil mechanism is designed so the sprocket can, under some conditions, jump a tooth. This feature reduces the possibility of severe damage to the final drive. When too much rock finds its way into the track, however, the recoil mechanism cannot allow sufficient movement of the idler to feed the rock through. Result is the same as operating with an excessively tight track adjustment in addition to extra damage caused by the "rock crusher" action. The tendency to stretch-out the track causes unnecessary wear and strain on the track links, pins, and bushings.

Tight track absorbs horsepower and robs the tractor of its full productivity. And, this condition may result in damage to the tractor's final drives.

Track roller guards are designed to keep rocks out of the track and have proved their effectiveness under field operating conditions. They are the best insurance available to provide longer, more economical service life for final drives and all track component parts of tractors engaged in rock work. Additionally, these guards assist in holding the tracks on the rollers in rugged and steep slope terrain, reducing wear on the roller flanges and idler pilot rim.

When operating in fine abrasive rock, it is important for economical operation to recondition all track component parts before they have worn beyond the recommended wear limits.

Review tractor applications before starting a job. If operation in rock is encountered, or will be encountered, use the correct width track shoes and install track roller guards. Recondition track component parts at recommended limits of wear. A realistic approach to "tracks in rocks" applications will reduce downtime, operation and maintenance costs, and assure you the best financial return on your investment.

* * *

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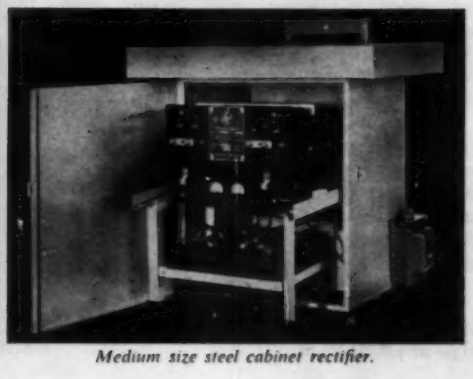
Small size steel cabinet rectifier.



Medium size steel cabinet rectifier.

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Pipe Wrappings • Graphite Anodes • Coke Breeze

Pipeline Contractors — Continued from page D-65.

● **Collins Construction Company, P. O. Box 86, Port Lavaca, Texas.** Has 26 miles offshore trenching for the *CATC Group* from Grand Isle, Louisiana, to a point 26 miles out into the Gulf of Mexico. Marine Gathering Corporation is the prime contractor, and Collins is burying the line being laid by Marine Gathering's pipeline laying barge. Has dual crossing of 10-in. lines on Detroit River between Windsor, Canada, and Detroit for *Canadian Brine Ltd.* Has trenching contract for 51 miles of 12 to 26-in. lines running from shore to offshore facilities at Cameron, Louisiana, for the *CATC Group.* Also has prime contract with *Accra-Mobil Overseas Oil Company* for 11,500 ft of 12-in. sea-loading line from shore at Accra, Ghana (Africa) to a depth of 50 ft.

● **Western Pipe Line, Inc., 1011 San Jacinto, Austin 66, Texas.** Has 94 miles of 30-in. for *Northern Ontario Pipe Line Crown Corporation* between Hawk Lake and Hyndeman, Ontario.

● **Panama Inc., 1418 Melrose Blvd., Houston, Texas.** Has contract for 362 miles of 16-in. for the *Texas-New Mexico Pipeline Company* from Jal, New Mexico, northwestward. Has 193 miles of 4 to 24-in. line in Mocane and Laverne, Oklahoma, fields for *Colorado Interstate Gas Company.*

● **Vaughn and Taylor Construction Company, Inc., P. O. Box 3266, Odessa, Texas.** Has contract for 48 miles of 8, 6, and 4-in. line between Kermit and Goldsmith, Texas, for *El Paso Natural Gas Company.*

PIPELINE PERSONALS

▸ Holly **Bradley,** safety supervisor of the Service Pipe Line Company, Tulsa, Oklahoma, has been elected chairman of the Mid-Continent division of the National Safety Council, Petroleum Section, during the organization's recent meeting in Chicago. He will promote participation in the National Safety Council activities by the petroleum industry in this area.

▸ **W. Earnest Graham,** a veteran of 27 years in the petroleum industry, has assumed the position of administrative manager, Little Big Inch division of Texas Eastern Transmission Corporation. Graham joins Texas Eastern from the Philzona Petroleum Company in Phoenix, Arizona, where he had been vice president and a company director.

Jamie T. Irvine has been named general sales manager for the Little Big Inch division. Formerly he was secretary-treasurer and a director of American Pipe Line Corporation.

W. E. Graham

E. T. Robinson Jr.

▸ **E. T. Robinson Jr.** has been named general superintendent of Texas Eastern Transmission Corporation's natural gas division. He will have direct supervision over pipeline and compressor station operations, gas measurement, corrosion control, and dispatching functions. He has been assistant general superintendent since 1954.

▸ **G. G. Billings** has been appointed to the newly created position of operations manager for Shell Pipe Line Corporation. Replacing him in his former post as manager of operating services will be **J. E. Green,** who has been a technical specialist in Shell Pipe Line's management organization. Both men will have headquarters in Houston.

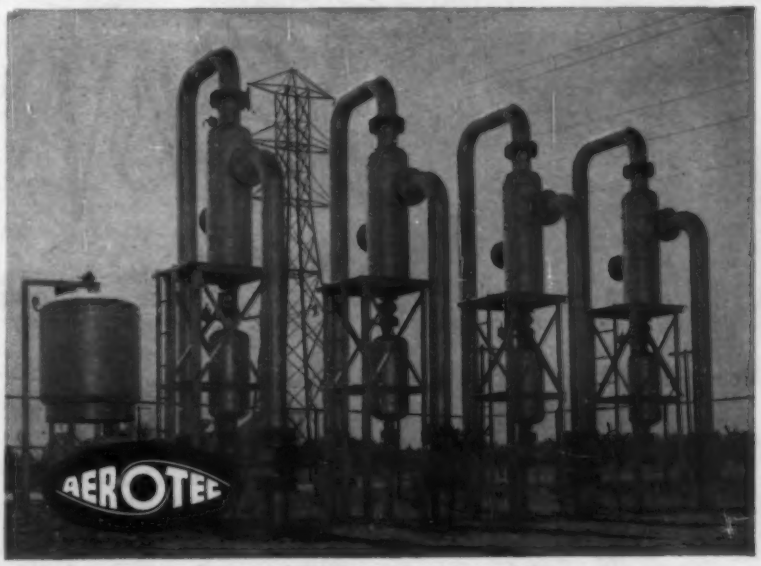
▸ **L. C. Poindexter** has been made chief engineer by United Gas Pipe Line Company, Shreveport, Louisiana. **C. W. Hollenshead** has been appointed superintendent of pipeline operations for the eastern division. Both men are long-time employees of United Gas. Poindexter also is a member of the board of directors, and has been general pipeline superintendent for the eastern division. Hollenshead has served as assistant to the superintendent of pipeline operations for the eastern division.

▸ **Frederick T. Poole** of Washington, D.C. has been named assistant general counsel to the Committee for Oil Pipe Lines. Poole's office will be in Washington where he will serve as assistant to Gordon Locke, general counsel to the Committee. He comes from the public relations firm of Selvage and Lee in Washington.

▸ **Harley M. McCamish,** former chief engineer of the Sui-Karachi Gas Transmission Pipeline of Pakistan, has been appointed manager of Mountain Fuel Supply Company's pipeline division with headquarters in Rock Springs, Wyoming.

▸ **D. S. Purnell** has been appointed manager of operations of the Laurel Pipe Line Company, recently formed to build and operate a common carrier products pipeline system between the Philadelphia and Cleveland areas. He is a former Sinclair Pipe Line Company division superintendent. **M. C. Miller,** from Gulf Oil Corporation, has been elected treasurer; **C. F. Sloss,** from Mene Grande Oil Company, assistant treasurer, and **R. P. Cassiano,** from Gulf, supervisor of employee relations and office services.

▸ **W. C. Kinsolving,** president of Sun Pipe Line Company and Sun-Canadian Pipe Line Company, has been named a member of the board of directors of the Fifth World Petroleum Congress, Inc. The board has been set up to organize the first international oil congress ever to be held in the United States. The event is expected to attract some 5000 scientists and technologists from over 35 countries to New York's Coliseum, where the six-day Congress will open on May 31, 1959. Kinsolving will be responsible for the Congress' transportation and distribution section.



cleaning gas without wetting agents

These four Aerotec Gas Scrubbers, operating in parallel, were installed by a large utility to clean the gas at the entrance to the Albany, New York distributing station.

Dry clean gas is a necessity at this critical point, and these units have been serving the community for several years with no liquid carry-over. They operate on the principle of centrifugally removing solid and liquid contaminants from gas, a method in use for many years in dust control.

Aerotec Dry Gas Scrubbers are serving the industry on practically every major gas line today. Their outstanding performance presents an unexcelled record and their comparatively small size simplifies installation in limited space.

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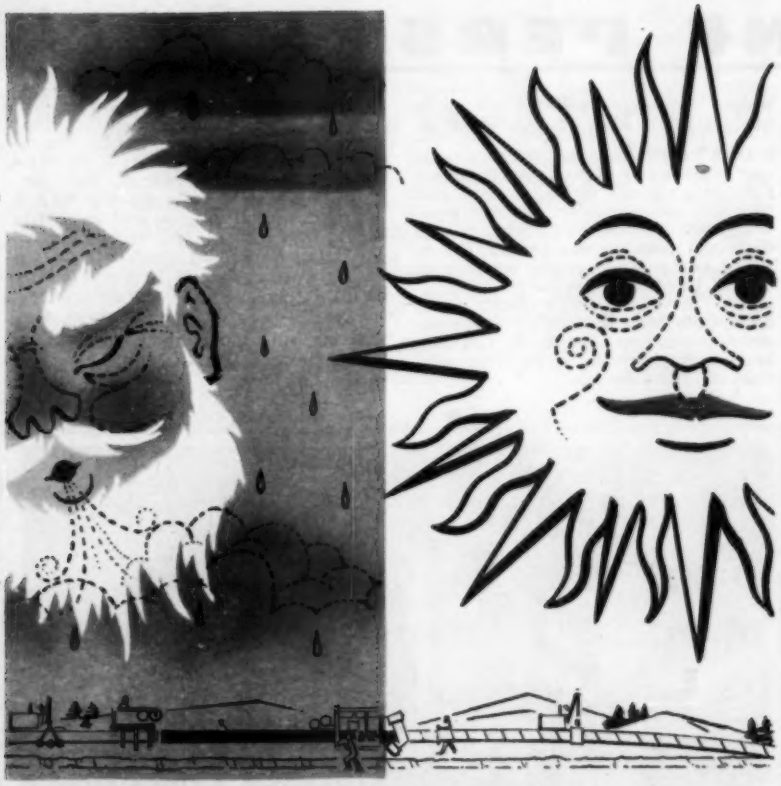

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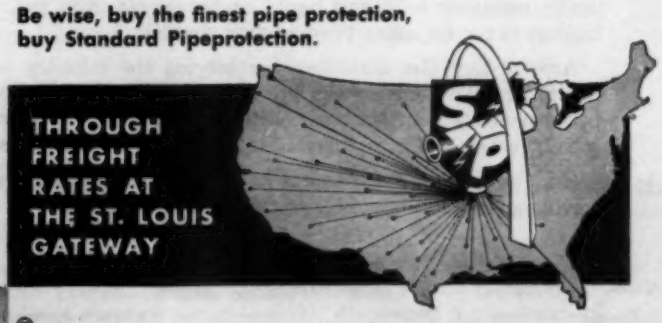

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Personals

Elvie G. Slaughter, pipeline foreman, has been transferred from the general office pipelines department to the Little Big Inch Division, Texas Eastern Transmission Corporation. Slaughter began work for Texas Eastern in 1947 as a maintenance foreman in Division I. From Division I he was transferred to Division IV; he was later moved to the pipelines section in the same division, where he served until his transfer.

Assignment changes, promotions, and transfers of key supervisors in its compressor stations department are announced by Transcontinental Gas Pipe Line Corporation. **N. W. "Tim" Lassiter Jr.,** present division superintendent at Charlottesville, Virginia, goes to Corpus Christi, Texas, as superintendent of the newly created Compressor Division I. **W. H. Buckingham,** now senior engineer in the Houston headquarters of the compressor stations department, becomes superintendent of Compressor Division II, offices at Baton Rouge. **L. F. Cowling** continues as division superintendent at Atlanta. **J. D. White,** present division superintendent at Baton Rouge, will be superintendent of Compressor Division IV with offices at Charlottesville, Virginia. In the Houston headquarters of the compressor stations department, **W. W. Adams Jr.,** formerly superintendent of Station 4 at Sour Lake, Texas, becomes senior engineer. **Joe G. Fleniken,** former superintendent of a compressor station in Virginia, has been moved to Sour Lake as the new superintendent of Station 4. **Robert V. Leffers,** named superintendent of Station 17, near Appomattox, Virginia. Before his promotion, he was repair foreman at the station. **Gordon D. Myers,** former superintendent of the compressor station near Davidson, North Carolina, moves to Eunice, Louisiana, as superintendent of Transco's Compressor Station No. 5. **J. O. Burdett,** repair foreman at a compressor station near Philadelphia, becomes the new superintendent of Station No. 15, Davidson. **Frank R. Keveryn** moved to superintendent of a gas conditioning plant to be constructed in the near future near Pleasanton, Texas. Keveryn is now repair foreman at a Transco compressor station near Clanton, Alabama. Superintendents of three new compressor stations also have been named. On completion of the stations, these men will assume their new positions. Each is now overseeing station construction as a Transco inspector. They are **Otho H. Lane,** Station 34, near Kings Mountain, North Carolina; **A. E. Hamalainen,** Station 36, near Chatham, Virginia, and **R. L. McIntyre,** Station 38, near Manassas, Virginia.

W. R. Whittenburg, Continental Pipe Line Company, is a new member of The Pipe Liners Club of Tulsa. Other new members are: **Murray C. McNichol, G. L. Maciula,** and **A. C. Golden,** of Service Pipe Line Company; **William L. Link, N. B. Mavris,** and **Ivan H. Ricketts,** of Continental; **D. H. Curry,** Mid-Continent Pipe Line Company; **J. C. Bivin,** Kerr-McGee Oil Industries, Inc., and **W. R. Bleakley,** associate professor, University of Tulsa.

Ralph K. Paine, manager, pipeline department, Standard Oil Company of California, San Francisco, was elected president of the Pipe Liners Club at the annual meeting in Chicago during the API convention. He succeeds **J. H. Woods Jr.,** vice president of Atlantic Pipe Line Company, Dallas.

FOR FURTHER INFORMATION ON ADVERTISED PRODUCTS, SEE READER SERVICE CARD

Canadian News Notes

Crown line contracts. Five pipeline contractors will construct the 367 miles of 30-in. natural gas line making up the second stage of the Northern Ontario Pipe Line Corporation project, between Port Arthur and Kapuskasing, Ontario. Total mileage of the Crown line will be 667 miles, including the 1957 construction now being wound up. It will be leased to Trans-Canada Pipe Lines, Ltd. for operation after completion.

Spread V, 63.6 miles from Milepost 310.7 to MP 374.3 (south bank of Nipigon River), has been awarded to Nelen, Ltd. for $4,069,972. Spread W, 48.1 miles from this point to MP 422.6 near the mining town of Beardmore, went to Morrison-Shivers, Ltd. for $4,070,590. Spread X, 70.9 miles between Beardmore and a point six miles east of Longlac, MP 493.5, was let to Majestic Contractors, Ltd. for $3,815,308. Spread Y, containing 91.3 miles from Longlac to MP 584.8 at the east bank of the Shekak River 30 miles west of Hearst, went to Canadian River Construction, Ltd. for $4,807,903. Spread Z, 92.9 miles terminating at the west bank of the Kapuskasing River at MP 677.7, the end of the Crown line, was let to Mannix Company, Ltd. for $4,064,015.

All contractors are planning an immediate start on right-of-way clearing and brushing while the ground is frozen, in order to get riprap laid on any muskeg or swamp portions when it is easy to travel over them. As much rock drilling and shooting as is practicable also will be done this winter, depending on weather. Snow is fairly deep now in most of the territory and considerable bulldozing will have to be done.

Majestic has established a field office at Geraldton, Ontario, with K. B. (Rusty) Killingsworth as spread superintendent. Canadian River will work out of a mobile trailer camp field office 50 miles east of Longlac, as no accommodation exists on its section. E. L. (Tex) Maggard will be spread superintendent, bringing the spread down from Dawson Creek where it recently finished laying a gathering system for Westcoast Transmission Company, Ltd. J. C. Minyard is general superintendent.

Westspur traffic growing. Traffic volume of Westspur Pipe Line Company is growing rapidly because of the wide open market for crude oil from southeastern Saskatchewan, its area of operations. From a starting throughput of 3000 bbl per day in July last year, Westspur climbed to 38,000 bbl per day last January, edging up to 50,000 bbl per day in July, then soared to 60,968 bbl in September and 71,787 bbl per day in October. November throughput, estimated at 69,500 bbl per day, showed only a slight recession whereas Alberta production allowables reached a new low because of the tight crude oil marketing situation for this province.

Westspur volume has been increased by making available a 16-in. loop of the original 12-in. line. Total rated capacity of the system is now 125,000 bbl per day, assuming a reasonable balance between light and medium gravity crude. The original 12-in. line is now used exclusively for medium gravity and the new loop for light oil.

Westcoast. Dutton-Williams Brothers, Ltd. has started work on right-of-way under a contract for 80 miles of gathering lines for the Westcoast Transmission Company natural gas grid system in the Peace River region. Current contract covers extension of the 20-in. main gathering line from MP 72 to MP 104, Alaska Highway, and construction of smaller

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diameter lines down to 6 in. for the Blueberry field and others in the area. Pat Campbell is general superintendent.

The spread under superintendent George Blair is working out of a mobile trailer camp at Blueberry. Doyle Cook is assistant superintendent. Right-of-way clearing and grade began November 10 and riprap is being laid down over the frozen ground through the muskeg terrain to provide a working surface for stringing this winter and pipelaying next summer. The right-of-way is unusually accessible as it is parallel to the Alaska Highway all the way along the main line, and seldom gets farther away than 1000 ft. Pipe is being unloaded now.

Sudbury lateral. Northern Ontario Natural Gas Company will construct a lateral gas line to connect the mining city of Sudbury in north central Ontario with the main line of Trans-Canada Pipe Lines, Ltd., to be built next summer from Kapuskasing to Toronto. The Sudbury lateral will take off at North Bay and parallel the alternate trans-Canada hardsurfaced highway, providing easy access to right-of-way.

Northern also has the local distribution franchise for Sudbury, where the gigantic smelter of International Nickel Company is situated. This company will be the largest single purchaser of natural gas.

Route is being surveyed by helicopter and no date has been set for calling bids. Construction is to start in the spring, but it is expected the bids will be called early in the winter so that the contractor can get on the right-of-way to clear, grade, and riprap where necessary. Entire line is to be let as a single contract. Engineering details are not yet settled.

Line from Carbon field to Calgary. A 55-mile, 16-in. natural gas pipeline from the Carbon field to Calgary is in the planning stage by Canadian Western Natural Gas Company Ltd., distributing utility in Calgary. CWNG has signed up the entire reserves of the field, southeast of the city, from Shell Oil Company, owner of the field. Bids for construction will be called this winter, with work to be done in the spring and early summer. A gathering system in the Carbon field will be included as additional mileage.

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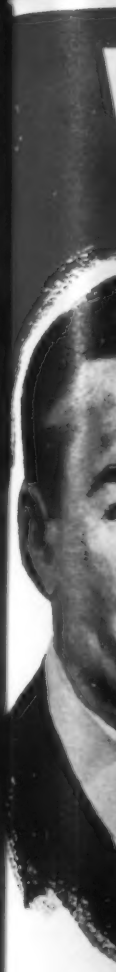

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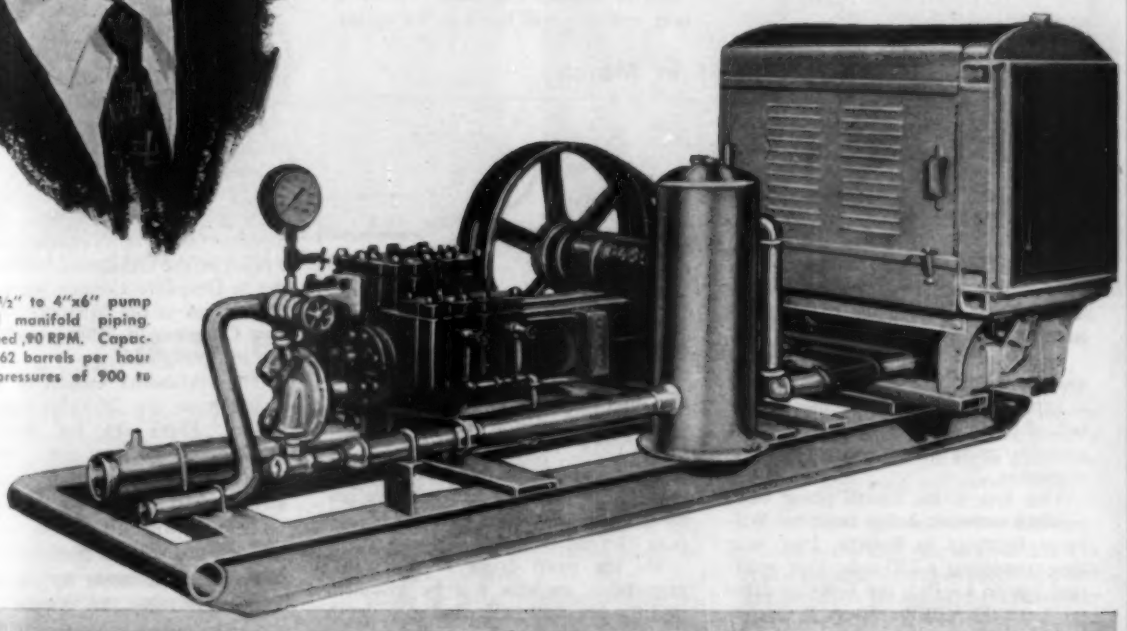

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Pipeline Projects

Transco-Eastern Shore $57 Million Plan Approved

Transcontinental Gas Pipe Line Corporation and Eastern Shore Natural Gas Company have been authorized by the Federal Power Commission to build nearly $57,000,000 of pipeline facilities.

The commission adopted an examiner's initial decision with several modifications. The most significant change withdrew authorization for Transcontinental to construct facilities for the transportation of natural gas for Virginia Electric Power Company, Richmond. The commission set a hearing for January 6 on the latter proposal.

Transco plans to build facilities in Texas, Louisiana, Mississippi, Alabama, Georgia, South Carolina, Virginia, and Maryland at an estimated cost of $53,700,000. Eastern Shore intends to construct more than $3,000,000 of facilities to serve the Eastern Shore areas of Delaware and Maryland.

254-Mile Pipeline Proposed for Alaska

Alaska Yukon Pipe Lines, Inc., has filed an application with the Fairbanks, Alaska, land office for permission to construct a 254-mile pipeline between Valdez and Tok Junction. Joseph Sparling, president of the company, said the line would cost between $5,000,000 and $6,000,000, and construction probably would begin in 1960.

Surveys Completed for Gas Line from Uintah Basin

Preliminary surveys have been completed by Pacific Northwest Pipe Line Corporation for the first major gas pipeline from northeast Utah's Uintah Basin. The line will tap reserves in Ute Trail area and transmit the gas to the company's main transmission line at a point in western Colorado. Construction probably will begin in the spring.

Bolivia-to-Chile Line to Start in March

Construction is expected to start in March on a 215-mile crude pipeline from the interior of Bolivia to the Chilean port of Arica, giving Bolivia its first outlet to the sea for its increasing crude production.

Line will be built by Williams Brothers Sudamericana, Ltd., under a contract signed with Yacimientos Petroliferos Fiscales Bolivianos, the Bolivian government's oil corporation.

Construction of line is expected to speed development of Bolivian fields, as export of crude has been blocked by lack of transportation, except for small amounts going across the border into Argentina.

This line is the fourth phase of a pipeline network being built by Williams Brothers in Bolivia. Last year they completed a 230-mile, 6-in. products line to La Paz, the Bolivian capital, from the YPFB refinery at Cochabamba.

The new section, to be started upon delivery of pipe, probably in March, will consist of 171 miles of 10-in. and 44 miles of 8-in. pipe joining the existing line at Sica Sica and carrying crude to Arica.

Contract also calls for construction of loading facilities at Arica, including a 300,000-bbl tank farm.

Designed for 1500-psi operation, with an initial capacity of 6000 bbl per day, the line will have an inherent capacity of 50,000 bbl by addition of two intermediate pump stations.

Target completion date is November 1, 1958.

When completed, line will cross the Andes at a point 14,531 ft above sea level, and at one point will drop 12,250 ft in 43.5 miles.

On the steep drops to the coast, restraining anchors will be installed, and the line will be buried to a depth greater than normal in order to provide additional stability.

Because of the high altitude, line construction will require special facilities for both men and equipment. In building the Cochabamba-La Paz line, Williams Brothers found that first-aid equipment must include oxygen tanks to be used in reviving men who faint from over-exertion in the thin air.

Special high altitude jets are required on engines used in laying the line, and Williams has made its own superchargers for the tractors.

Northern Natural Files Budget-Type Application

An application by Northern Natural Gas Company seeking authorization to construct facilities estimated to cost approximately $6,000,000, to attach new supplies of natural gas during 1957 and 1958, has been accepted for filing by the Federal Power Commission.

Northern said its application was of the budget-type, consistent with a previous policy declaration of the commission, designed to eliminate numerous small filings during the balance of 1957 and in 1958. The company estimates proposed construction costs of approximately $1,500,000 for the last half of 1957 and about $4,500,000 for the year 1958.

Pipeline From Oklahoma Into Missouri Planned

Applications have been filed with the Federal Power Commission and the Missouri Public Service Commission, which, if granted, would result in construction of a pipeline from Pottawatomie County, Oklahoma, to Pacific, Missouri, near St. Louis.

Mookl Chemical and Gas Corporation, Tulsa, Oklahoma, has asked FPC for a permit to lay 169 miles of 16-in. pipeline from Pottawatomie County to a point on the Oklahoma-Missouri border in Delaware County, where it will deliver gas to the Missouri Transmission Corporation, whose headquarters are in Springfield.

The Oklahoma section of the line would have one 2000-hp compressor station. Plans are for delivery of 100,000,000 cu ft of gas a day.

Missouri Transmission would construct a 256-mile, 16-in. line from the Oklahoma-Missouri border, extending northeastward to its destination.

Principal customer for the gas, it is said, would be the Atomic Energy Commission plant at Pacific, but gas also would be sold to distributors en route.

The Tulsa company is said to have firm contracts for 150,000,000 cu ft of gas a day, and both pipeline systems later would increase their capacities to this volume.

Fish Engineering Company, Houston, Texas, is doing the engineering for Mookl, and De Golyer and MacNaughton, Dallas, is making gas reserve estimates.

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Jayhawk to Lay Pipeline From Southwestern Kansas

The Jayhawk Pipe Line Corporation has been formed to construct and operate a 242-mile, 10 and 12-in. pipeline from southwestern Kansas to a point near Wichita, officials of the National Cooperative Refinery Association and Colorado Oil and Gas Corporation, announce. Approval is now being sought from the Kansas Corporation Commission.

The line will originate in the Novinger field, Meade County, and terminate at Valley Center, north of Wichita. There will also be an extensive gathering system serving numerous other fields in southwestern Kansas.

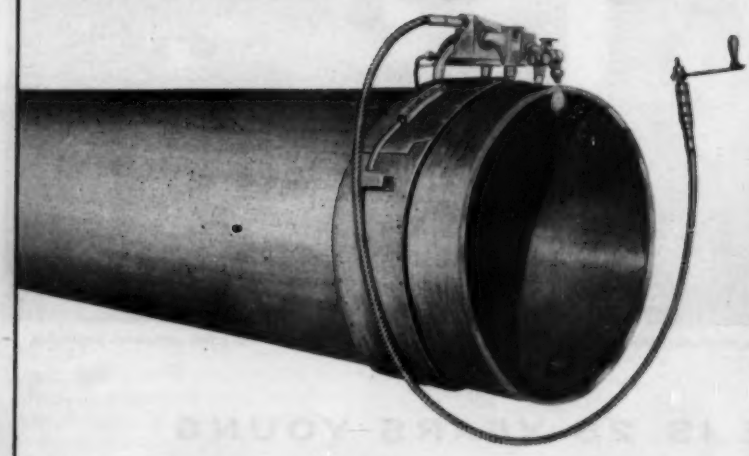
Principal customers of the pipeline will be National Cooperative refinery at McPherson and the Derby refinery at Wichita.

Initial capacity of the system will be 15,000 to 20,000 bbl a day.

J. W. Meehan, president of Jayhawk, is a vice president of Derby Refining Company, a wholly-owned subsidiary of Colorado Oil and Gas Corporation.

BEVELS 6" PIPE

BEVELS 48" PIPE



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$25,000,000 Project Gets Final Certificates

Federal Power Commission has issued final certificates to Gulf Interstate Gas Company for the construction of pipeline facilities estimated to cost $25,654,000, which will increase capacity to 575,000,000 cu ft of gas per day.

The new facilities in Kentucky, Tennessee, Mississippi, and Louisiana, will be used to transport 127,000,000 additional cu ft of gas per day for United Fuel Gas Company.

Gulf Interstate's project includes 69,000 hp in 10 main line compressor stations in Kentucky, Tennessee, Mississippi, and Louisiana; a 550-hp compressor station at East Mud Lake field, Cameron Parish, Louisiana, and about 10.2 miles of 12-in. loop supply line to the Erath field, Vermilion Parish. These facilities are estimated to cost about $25,382,000. FPC last April granted Gulf Interstate temporary authority to construct these facilities, and last month it issued a temporary certificate for their operation.

Gulf Interstate also will construct 8.7 miles of various diameter field lines in Acadia and Vermilion parishes, at an estimated cost of approximately $272,000.

Five Companies Studying Crude Line From Hugoton

Five companies are making surveys in southwestern Kansas to determine whether a crude oil pipeline from the Hugoton field to Wichita is commercially feasible.

The companies are Derby Oil Company, Wichita; Colorado Oil and Gas Company, Denver; Sunflower Pipe Line Company; Southern Kansas Pipe Line Company, and Oil Field Pipe Line Company, the last three of Wichita.

Spokesmen for Derby and Colorado said construction would begin early in 1958 if a pipeline is found feasible, with delivery of crude to Wichita refineries before the end of the year.

Permian Basin Pipeline to Tie-in Gasoline Plant

Permian Basin Pipeline Company has applied to the Federal Power Commission for authority to construct 26.8 miles of 10-in. lateral line extending from a point on Permian's existing system in Pecos County, Texas, to a gasoline plant owned by three independent gas producers, also in Pecos County. Facilities would be used to enable Permian to purchase and receive residue gas from the producers at the outlet side of their Imperial No. 2 gasoline plant.

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Front view of the CP-12 in operation at Peoples Natural Gas Company.

A pair of CP naturally aspirated, spark ignited natural gas engines, developing a total of 260 h.p., are installed at The Peoples Natural Gas Company, McKeesport, Pa. These units generate electricity to run water pumps cooling a bank of compressors, electricity for fan chilling the cooling water, and electricity for plant lighting and instrumentation. Operators report that these engines are easy to start, simple to maintain and respond promptly to load changes. Since their installation in September 1952, these CP Gas Engines have been rated as among the best engines of their type in the gas transmission system of this company.

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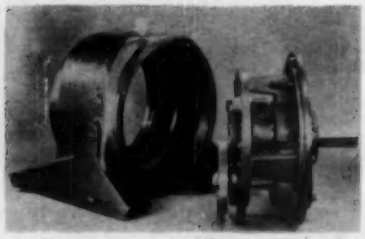
For more information on items described here in brief, use the handy reply card and circle the corresponding numbers

New Gearing Line. A new line of helical-gear, speed-reducing apparatus, called Moduline, has been announced by Westinghouse. The heart of the gear line is a double-reduction cage with a fixed 5 to 1 set of low-speed gears. Spin-flame heat-treated high-speed change gears are mounted on rolled spline shafts so that they can be mounted or replaced with common hand tools. Gears in the triple and quadruple reduction subassemblies are also spline mounted.



All gears are precision ground after hardening and meet AGMA standards for master gears. A total of 7 unit sizes to 30 hp are available with ratios of 5 to 1 to 625 to 1. Every unit has overhung load capacity in excess of any loads expected in service when using sprockets, pinions or pulleys for power take-off. *Westinghouse Electric Corporation.*

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Cadmium Battery. The Cadmium battery is now being supplied in unlimited quantities to new car dealers and other retail automotive outlets. While the European-type nickel-cadmium batteries have been considered too big and expensive for ordinary use, The Cadmium battery is no larger than present conventional batteries, and no higher in price than present-day premium types. The battery is described as a practical combination of the European cadmium batteries and the most advanced U. S. lead-acid types. *The Cadmium Battery Corp.*

Circle number (82) on reply card.

Gyrodozer. A new bulldozer for the Caterpillar D7 tractor, representing a new concept in bulldozer design, has been made available by Caterpillar. Designating the Caterpillar No. 7G bulldozer, and referred to as the Gyrodozer, this earth-moving tool combines the functions of ripping and moving material in one bulldozing operation, and in many applications eliminate the need for a separate ripping operation. Working in hard to handle material, it produces full bladeloads in less time and shorter distances. Key factors in the higher production of the Gyrodozer are 4 penetrating teeth mounted on the cutting edge of the bulldozer blade. These teeth extend forward 23 in. in front of the cutting edge, and are used in ripping up stubborn material in order to more rapidly obtain full loading of the blade. *Caterpillar Tractor Co.*

Circle number (83) on reply card.

LPG Metering Assemblies. Complete LPG metering assemblies incorporating Brodie BiRotor meter, strainer and differential valve for use in loading facilities, tank trucks, fueling operations, and other bulk transfers, have been announced by

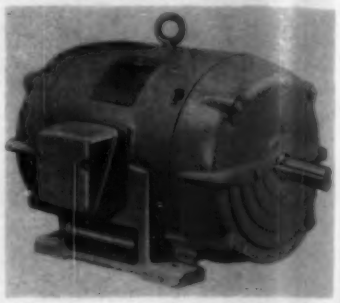
Ralph N. Brodie Company. Assemblies are available in models designed to handle 30, 50 or 80 gpm. *Ralph N. Brodie Company.*

Circle number (84) on reply card.

Line Pipe In Standard Sizes. Electricweld line pipe for the transportation of crude oil, refined products and gas is being produced in standard sizes from 6⅝ in. OD to 12¾ in. OD by Jones & Laughlin Steel. Lengths up to 60 ft can be produced, reducing the number of field welds to a minimum. This product meets the requirements of the API standards, 5-L and 5-LX. *Jones & Laughlin Steel Corporation.*

Circle number (85) on reply card

Synchro-Spede Motor. Louis Allis Company announces production of a synchronous induction motor built in the same NEMA frame size as a standard motor of equal horsepower. Called the Synchro-Spede, this motor accelerates as an induction motor but runs at exact speed without permanent magnets or d-c excitation involving collector rings and brushes, wound rotating fields, etc.



The Synchro-Spede is manufactured in ratings from 1 to 100 hp in any enclosure type and can be foot or flange-mounted. It is designed for horizontal or vertical mounting with a wide range of mechanical modifications available. *Louis Allis Company.*

Circle number (86) on reply card.

Carrier Current Design. A new carrier-current transmitter, fully transistorized for improved performance, is now being furnished to the utility industry by General Electric. Designated as Type CT-50B, the unit supersedes GE's Type CT-20 transmitter. Extensive use of transistors and other components having the benefit of long life contribute to the increased reliability of the device. The unit lowers maintenance costs by reducing the need for frequent checking. The transmitter is crystal-controlled and can be operated on any specified frequency from 30 to 200 kc. The operating frequency is stabilized because the 2 oscillators used have similar temperature-stability characteristics. *General Electric, Communication Products Dept.*

Circle number (87) on reply card.

Uprating Compressor Horsepower. Through use of conversion kits, horsepower ratings of many existing 2-cycle engine-driven compressors can now be increased substantially, and for relatively low investment. At the same time fuel economics can be improved considerably. In addition to increased horsepower, these field conversion kits provide the uprated engines with even greater overload capacity than was previously possible. Prior to this time, all engines had to be derated for altitude. However, these same engines with turbochargers modified for altitude now pull their full sea level ratings at elevations up to 7500 ft. Two types of kits have been developed for converting existing Cooper-Bessemer 2-cycle engines. One type kit provides a parallel turbocharging system, the second a series turbocharging system. *The Cooper-Bessemer Corporation.*

Circle number (119) on reply card.

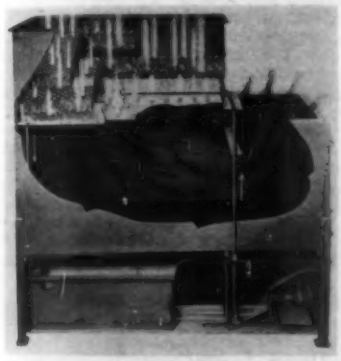
Two-Spindle Nutsetter. A new 2-spindle nutsetter which feeds and runs down wing nuts automatically, utilizing integral air-driven nutsetters with nut-tension control, has been built by Thor Power Tool Company. The nutsetter is engineered to fasten together the sponge mop and handle at the rate of 20 mops a minute and 1200 an hour. The operator need only pick up the sponge mop and the handle, placing handle over studs and pushing it under the nutsetter units. This automatically activates the machine by means of air valves. An electrically driven vibratory unit feeds 2 wing nuts into position and the machine's 2 air screwdrivers run down the wing nuts. Nut tightness and screwdriver torque are controlled by a Thor air regulator which prevents over-driving the nut or breaking the studs. *Thor Power Tool Company.*

Circle number (88) on reply card.

10 to 15-kw Electric Plants. The new HC series is available in either 10,000 or 15,000 watt a-c size ranges in voltages to 460 volts. Completely self-contained, these gasoline engine driven units will provide full-rated electric power for all types of standby emergency applications. *D. W. Onan & Sons Inc.*

Circle number (89) on reply card.

Cycoil Oil Bath Aftercleaner. A completely redesigned Cycoil oil bath aftercleaner has been introduced by American Air Filter. The new P-17 Cycoil is designed especially for collecting dust particles that might escape conventional dry centrifugals or viscous impingement filters.



The P-17 Cycoil is an automatic, self-cleaning dust collector that separates dust from the air as it passes through a viscous crimped-wire, fluid bed pad. The dust-laden air is mixed with the oil by means of a perforated plate over which the oil flows from a central distributing point. *American Air Filter Co., Inc.*

Circle number (90) on reply card.

48-in. Bumper-to-Back-of-Cab. A new line of International cab-over-engine truck tractors with unique 48-in. bumper-to-back-of-cab dimension to haul maximum payloads has been placed in production by the motor truck division of International Harvester. Designated as "Sightliner" models, these trucks are offered in the ACO-190, -200, and -220 series, are available in gross vehicle weight ratings from 24,000 to 30,000 lb, and come in 5 wheelbases. They are powered by International heavy-duty V-8 gasoline or LPG engines, and will be available with diesel power at an early date. *International Harvester Company.*

Circle number (91) on reply card.

Push-Button Weld-Cycle Control. The development of a new weld-cycle control unit designed to provide programmed control of all functions of machine heliwelding is announced by Air Reduction. The unit consists of a main panel which contains all of the adjustable control mechanisms, and a push-button remote control station. The system is for use with high-frequency current and d-c straight-polarity welding power from a saturable-reactor-controlled rectifier-type supply. Designed for applications requiring precise weld timing and crater filling on repetitive circumferential or longitudinal welds, it simplifies the heliwelding of production items such as canteens and transistor cases. *Air Reduction Sales Company, div. of Air Reduction Co., Inc.*

Circle number (92) on reply card.

Two Thousand Megacycle Scatter Link. The successful operation of a complete forward scatter communications link in frequencies above 2000 megacycles has been established by the research and development division of Allen B. Du Mont Laboratories. The path length of the Du Mont link is 124 mi, and transmission and reception are at 2180 megacycles. The transmitter is located at Cedar Grove, New Jersey, and the receiver is at Somers, Connecticut, near the Massachusetts state line. The equipment can be utilized for line of sight as well as scatter communication multi-channel links with potential applications in the petroleum and pipeline industries. *Research and Development Division, Allen B. Du Mont Laboratories, Incorporated.*

Circle number (93) on reply card.

Corrosion Can Take a Holiday

IN PIPE COATINGS AND WRAPPINGS OR IN PROTECTIVE PAINTS

Tinker and Rasor Holiday Detectors can assure this fact. They are an insurance policy that you are getting what you pay for in applied protective coatings. Tinker and Rasor pipeline (jeeps) holiday detectors are your inspector's right hand. They can give him the best quality control possible. On transmission lines he can spot trouble, as soon as it develops, such as clogged sprays on dope machine (which leaves pipe uncoated but covered with outerwrap), carbonized particles in bitumens, etc.

MODEL HP US Patent #2629002 (electrode)

LINE-TRAVELING

The model HP self-contained line-traveling detector, has its own power supply (wet cell battery); needs no ground wire and operates equally well on damp or dry pipe. Adaptable on any size transmission pipelines.

SHOULDER-PACK

Tinker and Rasor shoulder-pack holiday detector is designed to give the best possible inspection. It offers an adjustable voltage output range from 5,000 to 20,000 volts of sharp pulse type voltage which puts less stress on protective coatings. This equipment is available with conductive silicone brush type electrodes (non-fouling in soft coatings), for inspecting flat or irregular surfaces and with full and a half circle spring electrodes. This model will inspect damp or dry coating equally well and, as in all Tinker and Rasor detectors, has audible bell signal.

MODEL SP

MODEL M 1

PAINT AND THIN FILM

Tinker and Rasor Model M 1 detector is used for inspection of thin films where complete protection is a necessity. The detector has a bell alarm signal and is equipped with a leather case and belt loop. The potential of inspection is 67 volts. Not a spark detector, it operates with a damp cellulose sponge mounted on a phenolic wand handle. Pin holes can be pin pointed by using a corner of the sponge once a holiday has been detected.

TINKER & RASOR

417 Agostino Rd.(P.O. Box 281), SAN GABRIEL, CALIF. • ATlantic 7-7942

DISTRIBUTORS: Crutcher-Rolfs-Cummings, Inc., Houston, Texas, Remco Manufacturing Company, Inc., Tulsa, Oklahoma, Canadian Equipment Sales and Service, Ltd., Edmonton, Alberta, Bob Herrick, Rentals and Service, Harrisburg, Penna., Falcon Line Products Corp., Elizabeth, N.J.
Export Agents: Frazar and Hansen, Ltd., San Francisco, Calif.

New Equipment

RF Signal Generator. An RF signal generator especially designed for servicing land mobile communications systems has been announced by Motorola. This signal generator provides complete coverage of all land mobile communications bands presently used for 2-way mobile and base stations radio operation. Six individually calibrated, direct-reading scales cover the 25-54, 140-175, 400-470, and 890-960 mc bands. This signal generator is unusually light and compact. It weighs only 26 lb, measures only 10 by 14 by 7¼ in., and is easily carried. *Motorola, Inc.*

Circle number (94) on reply card.

Long-Wear Magnetic Tapes. Two new long-wearing magnetic tapes for instrumentation use that outwear conventional Scotch brand instrumentation tapes by an average of 6 to 1—yet increase short wave length response by 3.5 db—have been introduced by Minnesota Mining and Manufacturing. The magnetic tapes are designated No. 148 and No. 149. They are expected to find wide use throughout the instrumentation recording field wherever higher tape speeds, head pressures and temperatures (up to 200 F) are encountered. *Minnesota Mining and Manufacturing Company.*

Circle number (95) on reply card.

Automatic Line Oiler. A new automatic line oiler which shuts off the air supply when the oil is used up is now being manufactured and marketed by the Le Roi Division. Lack of oil, the most prevalent cause of air tool damage, is eliminated by the new L0380, which is light in weight, easily adjusted, and refillable while in use. The positive type oil-pickup feeds oil the instant drilling starts; the moment the oil supply is exhausted, the air supply to the air tool is shut off automatically. Its 1-pint capacity is more than adequate for 1 shift of operation.

In addition to its automatic protection, the oiler prevents the waste of excessive oiling due to inadequate adjustments of conventional line oilers. The oiler can be refilled while in operation, thereby eliminating drilling interruptions. Oil flow, too, can be adjusted without shutting-off air pressure. Differential pressures are used to operate the automatic line oiler. *Le Roi Division, Westinghouse Air Brake Co.*

Circle number (96) on reply card.

Direct-Recording Visicorder. A new, 36-channel oscillograph, designed specifically to provide the widest and most convenient use of the advanced Visicorder principle of direct-recording, has been introduced by the Heiland Division of Minneapolis-Honeywell. Grid lines may be recorded simultaneously with time lines and galvanometer traces. All speeds are changed by push-button control. The instrument features 5 speeds in each of 3 ranges—from 0.1 to 160 in. per sec. All controls are located on the face of the instrument for instant use, whether rack or bench-mounted. The Model 1012 Visicorder has a frequency response of 3000 cps, achieved without peaked amplifiers of any kind. *Heiland Division, Minneapolis-Honeywell Regulator Company.*

Circle number (97) on reply card.

Uniclosed Footless Motor. A new uniclosed footless motor is now being manufactured by U. S. Electrical Motors. Designed for direct connection to driven equipment, this motor is supplied with a NEMA style C unimount bracket for automatic alignment. The motor is built to the latest NEMA specifications, making it extremely compact—more horsepower in less space. This footless motor is available in ratings from 1 to 30 hp. An exclusive Ventrifoil deflector directs air and deflects water. The cast iron, 1-piece frame is heat-treated to prevent warpage and is completely dripproof. Windings are asbestos protected. A cast iron, split-type conduit box for easy access to motor leads is supplied and may be located above, below or on either side of the motor. Ball bearings are assured of long life by the U. S. Lubriflush System of lubrication. Rotors are solid cast and dynamically balanced. *U. S. Electrical Motors, Inc.*

Circle number (98) on reply card.

Development Eases Transition. A new development by Motorola called Dual Squelch has been added to its private-line radiophones to open the way to gradual conversion on a system to private, interference free mobile communications. The development also diversifies use of the equipment and permits noise free channel monitoring. With this, a fleet owner can modernize a private-line system on a gradual basis, since during the transition period, the Dual Squelch base station can receive from both the private-line and non-private-line mobiles in the system. Any of the private-line mobile units equipped with Dual Squelch can also listen to the non-private-line mobiles simply by turning a switch to dual operation. *Motorola Communications and Electronics, Inc.*

Circle number (99) on reply card.

Generator Starts Up To 40 Percent More Horsepower. Electric Machinery has developed a unique new generator. The machine features a static exciter and a voltage regulator with no moving parts. The regulator is of the magnetic amplifier type. The extremely fast voltage regulating ability of this type of regulator permits the generator to start larger motors. For example, a generator of conventional construction rated at 50 kw, 1200 rpm would start a 10 hp motor with full voltage starting and an allowable 25 percent voltage dip during starting. The E-M generator (50 kw, 1200 rpm) under the same condition will start a 15 hp motor. *Electric Machinery Mfg. Co.*

Circle number (100) on reply card.

Transit Crane-Excavator. Time-saving accessibility, low cost maintenance, versatile crane-excavator service, and fast, rubber-tired mobility — these are some of the significant advantages describing a new model transit machine — the 11-B — introduced by Bucyrus-Erie. It is readily convertible from a 10-ton lifting crane to a dragline, clamshell, hoe, or shovel. The 11-B is mounted on a modern 6-wheel drive carrier, which provides up to 47 mph speeds. *Bucyrus-Erie Company.*

Circle number (101) on reply card.

Telemeter Receiver. A multiple-printing strip-chart Metameter telemeter receiver has been announced by Bristol. The telemeter receiver will print out up to 16 separate records from as many telemetering transmission centers. Using a multiple-switching arrangement, the receiver can monitor successfully a large number of values from any distance necessary. The variables need not be all of 1 kind, but could be a combination of pressure, flow, temperature, liquid level, etc. *The Bristol Company.*

Circle number (102) on reply card.

...our SPY HOLIDAY DETECTORS are as near as your telephone—in fact, in emergencies our own plane assures immediate service.

Rugged equipment for dependable holiday detection on ¾" to 36" pipe...signal—bell, light and spark...unaffected by dew or frost.

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NEW Literature

For more information on items described here in brief, use the handy reply card and circle the corresponding numbers

Maintenance Guide. As an aid to operators, a new D7, D8 and D9 tractor Maintenance Guide has been prepared by Caterpillar. The 24-page guide has more than 75 color drawings of hints for obtaining optimum service life from Caterpillar-built equipment. Methods of preventing abnormal track wear are discussed in detail. Instructions for maintenance of seals, proper track adjustment and lubrication are illustrated. Specific directions show operators how to keep steering clutches, hydraulic boosters, control levers and brake components in best working order. Emphasis is placed on the correct adjustment of oil-type flywheel clutches and control lever operation. *Caterpillar Tractor Co.*

Circle number (103) on reply card.

How to Get Better Welds. "How to Get Better Welds" is a new and revised edition of Welders' Vest Pocket Guide containing 60 pages of useful arc welding information. This booklet gives information on metals and electrodes, 4 essentials of proper welding procedures, the fillet weld, types of joints, typical welding positions, welding symbols, standard steel shapes available for welding, causes of common welding troubles and what to do about them, definition of welding terms, weight of weld metal deposited, spark tests by grinding, factors to consider in selecting electrodes, types of electrodes, how to select welding electrodes to weld ferrous metals, how to select electrodes to weld corrosion-resisting steels, electrode identification key, explanation of AWS classification numbers and comparative index of welding electrodes. *Hobart Brothers Co.*

Circle number (104) on reply card.

TD-9 With Sideboom and Blade Backfiller. The International TD-9 crawler tractor, equipped with Superior sideboom and blade backfiller, is the subject of a new 8-page, 2-color booklet by International Harvester. With the Superior sideboom and Superior blade backfiller or anglefiller, the TD-9 is virtually a spread in itself on small pipeline construction jobs, lifting pipe loads as heavy as 17,000 lb at 4-ft overhang. *International Harvester Company.*

Circle number (105) on reply card.

Data on Autrometer. A new 8-page booklet, giving information on the improved Norelco autrometer, automatic indexing X-ray spectrograph, is available from the instruments division of Philips Electronics. Text explains the operation of this non-destructive analytical tool and describes how it prints out intensity ratios on 1 to 24 elements in a single sample with elapsed time frequently 1/50th that required for chemical analysis. Procedure is described for handling elements from No. 12 (magnesium) through those having the highest atomic numbers. *Philips Electronics, Inc.*

Circle number (106) on reply card.

Aluminum for Tanks and Vessels. A technical booklet on the use of aluminum for tanks and vessels is available. The booklet prepared by Reynolds Metals Company serves as a basic technical guide to design, fabrication and applications of aluminum tanks and vessels. It lists more than 100 general types of chemicals for which aluminum applications are particularly advantageous. *Reynolds Metals Company.*

Circle number (107) on reply card.

Pre-Set Compensating Springs. Bulletin No. 4-57 explains contraction or expansion of valve seat caused by decreasing or rising line temperatures. Type SA LimiTorque valve controls are equipped with Belleville disc type compensating springs that automatically assure a tight valve seat. For use in parallel or series, within fixed limits, these springs provide the desired compensation. The LimiTorque Type SA valve control has all the features of the well-known type SMA control plus a simple indicator to slow the amount of compensating spring compression. Available in weatherproof and explosion-proof construction, this unit can be field-mounted on any size valve in nearly any position. *Philadelphia Gear Works, Inc.*

Circle number (108) on reply card.

Weld Insert. A new 12-page booklet contains information to help obtain a sound root pass weld with the aid of a consumable insert when only 1 side of the weld is accessible. The booklet compares conventional methods of producing a root pass to the use of consumable EB weld inserts. Fifteen different insert compositions are classified for the welding of carbon steels, austenitic stainless steels, non-ferrous alloys and chrome-moly and chrome steels. *Arcos Corporation.*

Circle number (109) on reply card.

Air and Low Pressure Hydraulic Cylinders. New in the general automation field is the pre-tested Rovalve line of heavy duty air and low-pressure hydraulic cylinders. They are fully described in a catalog ready for 1958 distribution. As valve operators, the Rovalve heavy duty cylinders have shown excellent performance characteristics, reliability and long life. *W. G. Rovang and Associates, Inc.*

Circle number (110) on reply card.

50-100 Percent Sprocket Life. A first in the heavy machinery industry and a Caterpillar exclusive are the new Boralloy sprockets for Cat D8 and D9 tractors. The features of these sprockets, which wear up to twice as long, are described in "Boralloy," a 2-color booklet released by Caterpillar. Illustrated throughout with photographs, drawings and cutaways, this 8-page booklet describes the manufacture of these sprockets with emphasis on the role the element Boron plays in creating depth of hardness. *Caterpillar Tractor Co.*

Circle number (111) on reply card.

Two-Way Radio Equipment. Bulletins are available from Communications Company on 2 types of its equipment. Comco Model 450 is a complete VHF-FM base station designed for mobile and point-to-point radio systems. Flightcom Model 400 provides communications between ground FM systems and aircraft. Both types of equipment have FCC acceptance. *Communications Company, Inc.*

Circle number (112) on reply card.

Worm Gear Speed Reducers. Jones Machinery Division has issued a 40-page booklet on worm gear speed reducers. The booklet contains a description of various worm gear reducer designs with horsepower ranging from less than .1 to 121. *Hewitt-Robins, Inc.*

Circle number (113) on reply card.

Airfoil Centrifugal Fans. A new catalog entitled Airfoil Centrifugal Fans is available from Westinghouse. This catalog describes the efficiency and quietness of airfoil blading for all-purpose applications in a complete standard line of centrifugal fans (Series 8000) covering every requirement up to 700,000 cfm and up to 16¾-in. total pressure. *Westinghouse Electric Corporation, Sturtevant Division.*

Circle number (114) on reply card.

Power Shift Drive. Allis-Chalmers new power shift torque converter drive for fork lift trucks is presented in an 8-page, 2-color booklet (BU-465). Cutaway views of the drive and of the torque converter pictorially describe the operation of each unit. *Allis-Chalmers Manufacturing Company, Buda Division.*

Circle number (115) on reply card.

Big 3's Products and Services. Big 3 Welding Equipment Company has issued a new and exceedingly comprehensive catalog not only showing the wide range of products handled, but describing a number of unusual services offered. Seventy-six pages of illustrations and description cover in detail the latest types of electric and gas welding equipment, electric and pneumatic tools. Also included is equipment for pipeline construction, building fabrication, and many other industrial applications. *Big 3 Welding Equipment Company.*

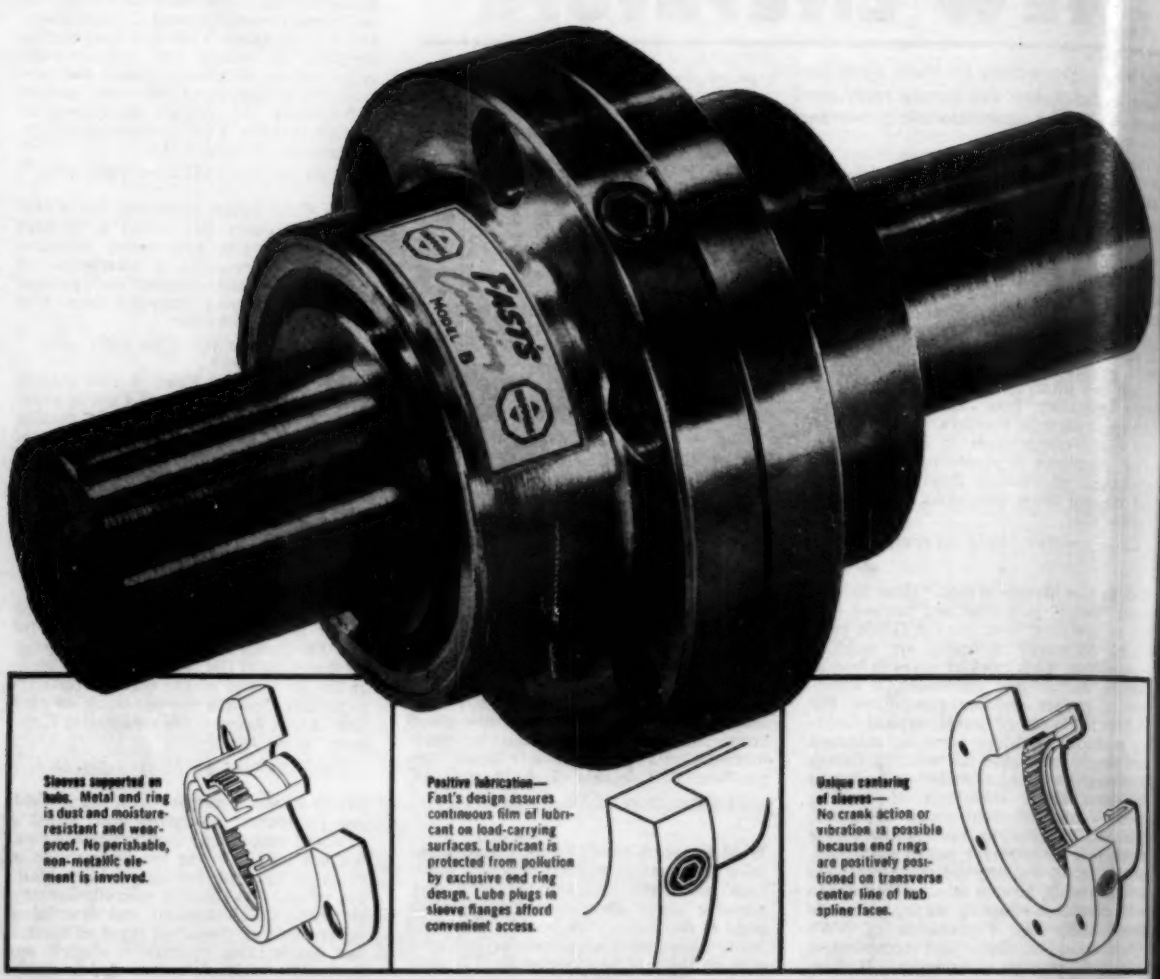
Circle number (116) on reply card.

TD-24 Torque Converter. International Harvester has issued a new 20-page catalog on the International TD-24 torque converter or gear drive crawler tractor. The catalog is divided into 12 sections which describe the features of the crawler tractor in detail. Highlighted in the presentation is a schematic drawing of the TD-24 which graphically points up all the new features. Basically, the TD-24 is equipped with a 4-cycle, 6-cylinder, 202-hp diesel engine designed for the roughest of earthmoving jobs. *International Harvester Company.*

Circle number (117) on reply card.

30-in. SWECO Separator Catalog. A catalog describing the new 30-in. SWECO vibrating screen separators has been issued. This equipment rounds out the SWECO separator line — giving an intermediate size between the company's 18-in. and 48-in. diameter units. SWECO separators are used in screening all types of dry materials and separation of solids from liquids. *Southwestern Engineering Company.*

Circle number (118) on reply card.



Sleeves supported on hubs. Metal end ring is dust and moisture-resistant and wear-proof. No perishable, non-metallic element is involved.

Positive lubrication— Fast's design assures continuous film of lubricant on load-carrying surfaces. Lubricant is protected from pollution by exclusive end ring design. Lube plugs in sleeve flanges afford convenient access.

Unique centering of sleeves— No crank action or vibration is possible because end rings are positively positioned on transverse center line of hub spline faces.

Fast's Model B coupling reduces downtime and upkeep for light-to-medium drives

Mechanical flexibility eliminates costly shutdowns and expensive shaft replacements. But—it's only one of many cost-saving features.

Now you can profit from the durability and economy of famous Fast's couplings in a smaller and lower-cost version—available in 3 sizes for shafts up to 2⅝" in diameter.

The Model B coupling gives you the same features that have made Fast's the world's leading coupling for over 35 years. You get the same trouble-free performance, longer service life and lower maintenance costs. You also get prompt delivery because stocks are on hand to meet practically every need. Free engineering service is also available.

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